The

Electrical Review

VOL. CVII. SEPTEMBER 5, 1930. No. 2754.

THE OLDEST ELECTRICAL PAPER. ESTABLISHED 1872.

Published every FRIDAY, Price 6d.

Chairman and Joint Managing Director: G. H. ALABASTER, COMPANION I.E.E.

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Telegraphic Address: "AGEEKAY, CENT, LONDON." Code, A B C. Telephone No.: Central 5871 (5 lines).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES, Postage Free: United Kingdom, £1 14s. 8d.; Canada, £1 12s. 6d. Colonial and Foreign, £3 1s. 6d. per annum. Cheques and Postal Orders on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, LIMITED, and crossed "Midland Bank, Newgate Street Branch."

For List of Foreign Agents for the ELECTRICAL REVIEW see Advertisement Supplement.

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Electrical Propaganda.

WE wonder whether we are in danger of becoming too stereotyped in our electrical propaganda efforts. Do those who represent us in the seats of authority lack originality and initiative? Are they afraid lest their imagination should be allowed to run riot?

Many questions of this kind have been and could be asked which would be described as querulous. And the reply to them from headquarters would probably be in the negative. The real explanation might be: "We have great ambitions and manifold schemes; what we have done has been good under the circumstances, and up our sleeves there are many enterprising projects—BUT—how can we set out to realise them without adequate means?"

It might even be imagined that the critical questioner, having a fixed habit of thinking of electrical things all the time, has become hardened, unresponsive, and not easily moved to enthusiastic reception of original conceptions. The spirit of appreciation may be lacking because of an absence of noise and an apparent want of newness in what passes before him.

Be these things as they may, we believe that the reply—want of funds—is a justifiable defence, for the support that the electrical industry renders to the movement is ridiculously small. We have an idea that those who run our representative organised efforts are as disappointed as we are that the rate of progress seems so slow. *If only the money were available*, what great things could be done! The people of the land would become electrified by the very zeal that our advocates could show, and, of course, the electrical industry itself would quicken materially the inflow of orders of all kinds into its factories.

We welcome all the suggestions that reach us from readers and writers; are anxious not to miss any of the hints, ideas, and experience originating in other countries; and we listen sympathetically to the points advanced by users of both gas and electricity—but we always have to fall back disappointed because so many things are beyond achievement until there is affluence at headquarters, unless they are done by some of the big concerns, which, mistakenly as we believe, hold aloof.

But even with the present limited annual funds (and

we are glad to know that their amount is gradually increasing) the subscribers and donors naturally look for a high standard of efficiency. In the past, even as far back as pre-organisation days, there were all sorts of ways adopted by private concerns, companies, and firms for arousing the electrical interest of the public; possibly some of those early ideas have been forgotten, or after being tried out by one display have been cast aside because they were regarded as too fanciful, too extravagant, too much like a "stunt," or impracticable from the common standpoint. And so, it may be felt that we have settled down to a range of electrically-equipped houses all more or less alike, shop windows and publicity literature which fail to maintain their original interest. Perhaps some of the earlier fancies might with profit be allowed a run again just to set the public interest alight once more—there is room for constant change in most things in this particular age, and propaganda, exhibition, and publicity methods may be in need of a little relief from monotony. Why not do something really startling? We may not like the word "stunt," but if a stunt will set electrical interest ablaze —why not? provided it be not of too low an order?

Well do we remember an electric house shown, we believe by a private exhibitor, at one of Olympia's early electrical exhibitions, wherein the serving of all the courses at an evening dinner was done electrically. A dish of rolls passed round, automatically stopping in front of each "guest" for a moment and passed on; then came the soup, and so on. Dirty platters were lowered down an oval well in the table and new courses rose from the depths without any seen human intervention, and (tell it not in Gath!) there was nobody to tip at the end! In the bedroom we pressed a button and the curtains magically swung back and the blinds went up, letting in the morning sunlight; we pressed another button and hot coffee and rolls came rumbling up from below into a bedside cupboard, and so on throughout the house. Even a pioneer scientist ran an electric railway from his kitchen quarters through a hole in the wall carrying the food on to the table in his dining room; and a wealthy Italian prince, well satisfied with his own company, had every service conceivable in his mansion rendered electrically, and the magazine Press of those days sat up and took notice! Fanciful altogether, no doubt, not calculated to bring actual orders for things as demonstrated, but the Olympia exhibit and these other things set people talking in a most interesting fashion. And are not these the things that sooner or later bring orders for multifarious products? Electricity is wonderful; but somehow we don't seem to rise to the occasion in advertising its many interesting and popular merits to the crowd. Is it entirely because we haven't got the money?

A Coming of Age.

CONGRATULATIONS to the Association of Mining Electrical Engineers upon having reached the eve of celebrating its twenty-first birthday!

In the history of electrical development, if the full story is ever written—fulfilling a wish often expressed to us—it will be found that the editors of the ELECTRICAL REVIEW have been responsible for the establishment of many of its representative associations. Sometimes we have been reproved for hiding our light under a bushel or for blowing our own trumpet less than we were justified in doing, but we have recognised that in our unique position in the industry it has been our duty to give written and practical leadership whenever we have considered that a movement was really meritorious and expressed an actual need.

The Association of Mining Electrical Engineers held its inaugural meeting at Manchester on December 17th, 1909, when President William Maurice "gave an account of the origin and development of the new Institution *which took its rise in a leading article in the* ELECTRICAL REVIEW *on December 11th, 1908, followed by letters from various correspondents . . .* on April 24th a meeting was held at which it was decided to form a society, commencing with 50 members—a number which was quickly trebled." (ELEC. REV., December 31st, 1909, p. 1055.) In our editorial reference to the meeting we praised the energy and organising ability of "one of our correspondents," Mr. J. G. Williams, "the founder" of the Institution, and we closed with these words: "Founded thus on personal merit and technical ability, the Institution will be enabled to claim, and obtain, for its members due recognition as men who may be relied upon to know their work and to do their duty."

The Association to-day has ten branches and seven sub-branches, with a large membership in Great Britain. We congratulate it upon its record of achievement in fostering the interests of mining electrical engineers and of the efficient application of electricity in mines. That as an organisation it feels that there is yet much to be done, is obvious from an editorial remark in the August number of its excellent official organ—*The Mining Electrical Engineer*—saying that "the work of the A.M.E.E. is but in the beginning."

High-voltage Switching.

PROBLEMS attending the design of high-voltage switchgear have necessarily varied with developments in generation and transmission. In the earliest stages current-carrying capacity caused little concern, while ability to cope with short-circuits was generally ensured by the construction required to meet conditions imposed by voltage.

As the size of generating plant increased, rupturing capacity became a dominant consideration. Then, the raising of transmission voltages to 33 kV introduced, automatically, a relatively high-duty switch.

For the future it will be necessary to think in terms of grid operation, under which the energy available for feeding into a fault may reach a few million kVA. Amperage, also, will present far greater difficulties than hitherto, particularly when switching has to be carried out at generation pressure; local requirements may not always permit of switching at the higher-voltage terminals of transformers directly connected to alternators, or the use of high-voltage stators as at Brimsdown.

Switchgear constructed in accordance with present principles is a weak link in a circuit, and the reduction to a minimum of the number of circuit-breakers at grid sub-stations has advantages of greater importance than saving in capital expenditure. We think, however, that there is much to be said for the employment of duplicate (parallel) circuit breakers for very large generators, as suggested by Messrs. R. W. GREGORY and F. C. WINFIELD in the paper they presented to the Second World Power Conference, an abstract of which is given in this issue. It is easy to agree with the view there expressed that circuit-breaker design is still far from finality and to echo the hope that circuit-breaking will cease to be "explosive" in the not very distant future.

In present circumstances outdoor switchgear for the highest voltages is economical, but it is becoming increasingly evident that for the voltages in use on the systems of most undertakings the saving in capital expenditure through the elimination of buildings for switchgear is more than offset by difficulties in operation and maintenance.

Motor Speed Regulation.

THE system of regulating the speed of motors (especially boiler-house auxiliaries), described on a later page, has not, as far as we are aware, been used in this country. The method consists in the use of a three-phase squirrel-cage motor to provide the constant speed component, from which variations are obtained by means of d.c. from a localised motor-generator.

The energy used for speed variation may undergo three transformations, but, if the speed range is kept within reasonable limits, the proportion of such energy to the total is small—very much smaller than that required by the conversion of all the energy required to direct-current for the purposes of speed regulation.

Artificial-silk Manufacture.

A description of the electrical equipment at the new artificial-silk factory at Lowestoft of Alliance Artificial Silk, Ltd., outlining the modern applications of electricity in that industry.

(*Concluded from page* 329.)

In the spinning room there are 52 spinning machines, each driven by a 2½-h.p. explosion-proof motor controlled by a "Heyes" gas-tight thermal-type starter. The "dope" is fed into heated cabinets at the top of the spinning machines, and it is in these cabinets that the acetate solution is pressed through jets and the solvents evaporated. The spinning proper is effected immediately under the cabinets. The inspection of the solution streams and the filaments passing through the chambers is of considerable importance, and special arrangements are in vogue for this. In the top of the cabinet over each of the jets is a gas-tight lighting fitting equipped with a 60-W m.f. lamp, which projects obliquely downwards on to the filament, and below the cabinet is arranged a lamp at each bobbin. Each chamber lamp and its corresponding bobbin lamp are arranged on one separate circuit. The general lighting in the spinning room is excellent, and it is effected by gas-tight fittings by Veritys, Ltd., equipped with 300-W lamps, spaced 21 ft. apart and giving an illumination of 9 ft. candles at the working plane.

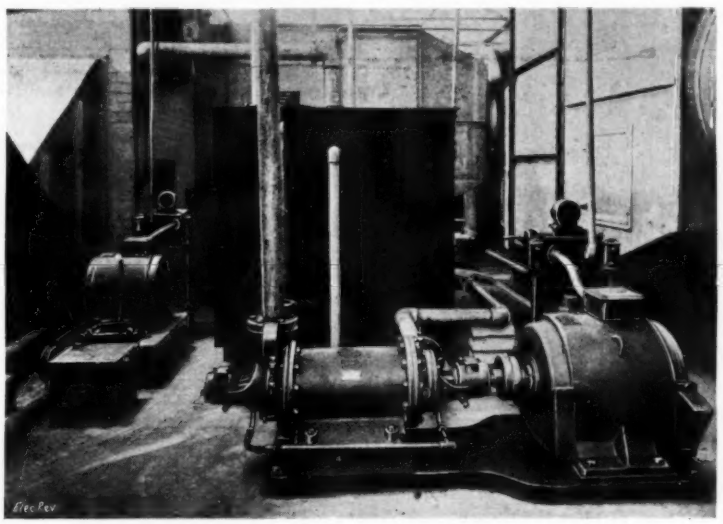


Fig. 6.—One of the Fan Chambers.

As already indicated, because of the risk of explosive-laden atmospheres in this section of the works, particular attention has been given to ventilation and to air conditioning. Five hundred h.p. of fan motors alone is employed on this work, including several 45-h.p. motors in specially constructed fan chambers. The bad air is taken out, filtered, humidified, and re-delivered as fresh air. Fig. 6 shows one of the fan chambers.

An outstanding feature of the twisting room is the lighting. There are 750 lighting points, each equipped with a 100-W lamp, so arranged to give an illumination of 13 ft. candles on the middle bobbins and 7 ft. candles

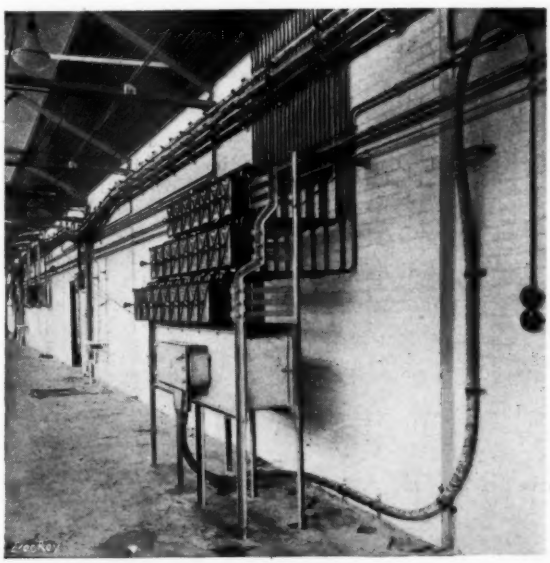


Fig. 7.—Lighting Control Board in Twisting Room.

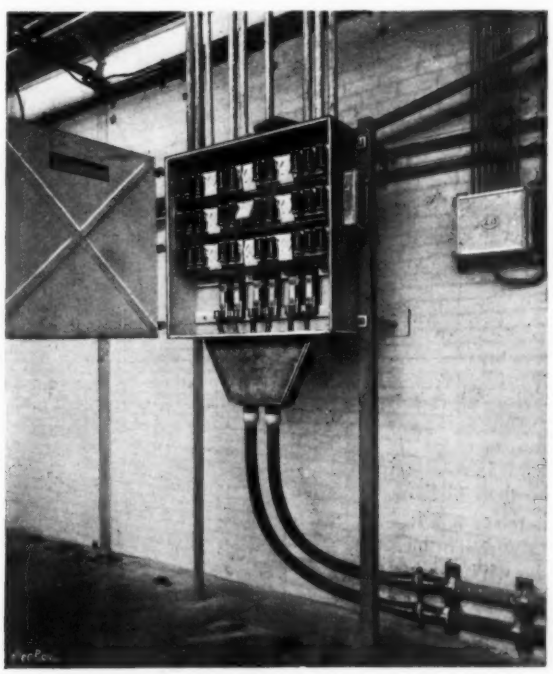


Fig. 8.—A Main Power Distribution Board.

on the lower ones. The room measures 600 ft. square, and the lighting points are staggered, and it is claimed

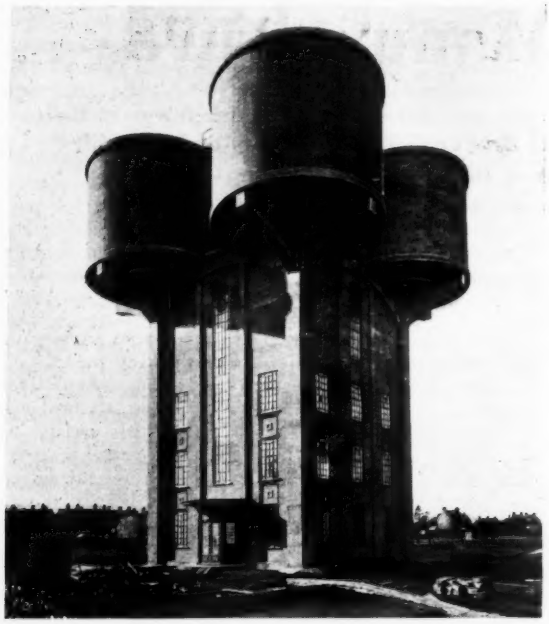


Fig. 9.—An Unusual Water-storage Tower.

that there can be no shadows under normal conditions. The lighting is controlled by 27 Berry-Skinner ironclad switches (50 A), fig. 7, each serving a sub-distribution board. Fig. 11 is a view in the twisting room, showing some of the 125 reeling machines, each of which is driven by a 6½-h.p. motor, controlled by an "Ellison" star-delta starter. The whole of the power distribution for this room is split up on three walls, on each of which there is a 10-way (120 A per way) "Fluvent" board, fig. 8. In the silk-grading room there is a "Dayton" thermostatically-controlled electrically-operated humidity regulator, and for the lighting of the grading machine 80 supply plugs are arranged along one wall.

Factories Nos. 3 and 4, which will probably be used as weaving factories, are each equipped with about 1,000 h.p. of motors, and they represent a full lighting load in the neighbourhood of 30 kW.

It is an interesting fact that the whole of the wiring work for the lighting throughout the factory was done on piece work, which was rendered possible by sectionalising work and cutting off the lengths of cable and conduit in bulk. The men welcomed the scheme, and were able to earn 25 per cent. more money. Fig. 10 is a typical example of the conduit work throughout the factory. The whole of the cables were supplied by Messrs. Johnson and Phillips, Ltd., and the conduit by the General Electric Co., Ltd. The lighting switches used are of the gas-tight type supplied by the Walsall Hardware Manufacturing Co., Ltd. The motors installed throughout the factory were supplied by Messrs. Mather & Platt, Ltd.

While not of particular electrical interest, except that water is pumped up into the tanks by two 55-h.p. electrically-driven pumps, the water-storage tower shown in fig. 9 represents a considerable general engineering achievement. The tower is 120 ft. high, and the tanks hold a total of 500,000 gal. of water. The supply to the factory and the power house is taken from the tower under gravity. The outside lighting is entirely by underground 4-core, p.i., l.c. cables, with distribution *via* a 9-way Johnson & Phillips pillar. The entire lighting for the offices, engineering workshops, canteen, joiners' shops, remote pumping stations and the fair ways, and the emergency and pilot lighting in the factories, are on dual control, so that, in the event of the power station shutting down for any unforseen reason, the lighting would be taken from the Lowestoft supply undertaking.

In order to train the necessary local labour and to form a nucleus staff of foremen and forewomen, a special school has been erected on the factory site, which is, in effect, a reproduction in miniature of the main factory described above.

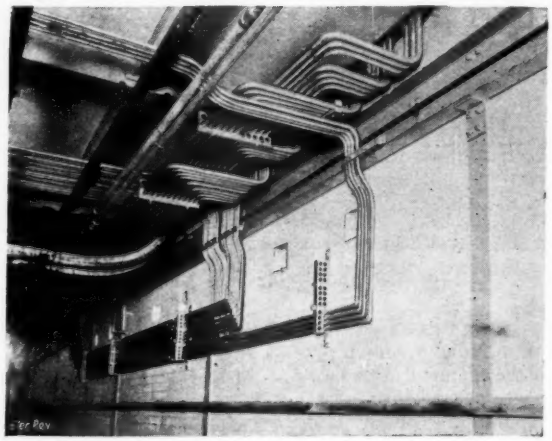


Fig. 10.—A Neat Conduit Job.

In conclusion, we are indebted to Alliance Artificial Silk, Ltd., for permission to view the factory, to Messrs. Mann, Egerton and Co., Ltd., for the accompanying illustrations, and to Mr. R. S. Whaley, A.M.I.Mech.E., A.I.E.E., formerly general manager of the Contracting Department of Mann, Egerton's, now manager of the contracts department of Messrs. Crompton Parkinson, Ltd., who designed and supervised the entire electrical installation, for his assistance in the collection of the above information.

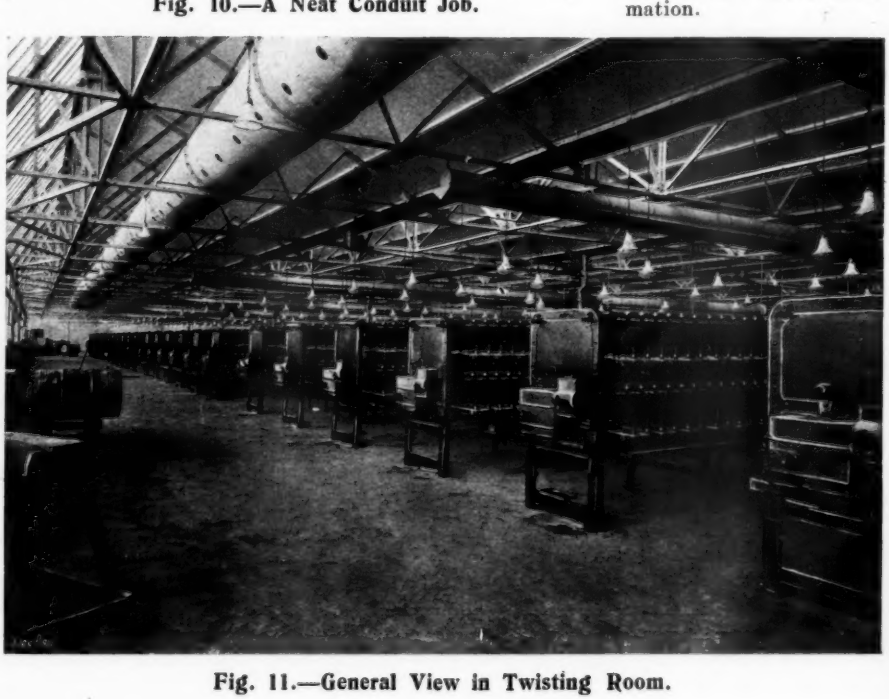


Fig. 11.—General View in Twisting Room.

Economical Flood-lighting.

Comments on the capabilities of "Blaizolite" projector lanterns, the special features of their design, and typical examples of their application to interior illumination and out-door flood-lighting.

LIGHT is one of the cheapest things we buy, one of the most useful, and one which, if we mistake not, has more to do with our dispositions and daily doings than we are wont to realise. The candle and oil lamp were limited, flickering, and feeble. Gas, too, is restricted by fetters, physical and economic, which limit it to local and static use. Electricity, however, has given the illuminating engineer true freedom; the unrivalled flexibility of electric light, its almost infinite variety in tone, colour, and intensity, both direct and reflective, are beginning to be used as they are capable of being utilised.

More frequently than should be, the illumination engineer has to attempt to satisfy intangible requirements, indefinitely specified; occasionally, however, he is permitted to design an installation in accordance with his own appreciation of the local conditions, often enabling him to accomplish results superior to the original conception of his clients. Thus the accompanying illustrations are by no means exceptional examples of the advantageous substitution of "Blaizolite" projectors for conventional lanterns. Said to be applicable wherever sufficient height is available, their special features include diffusion of the light, glare minimisation, small maintenance cost, and energy economy; for instance, a 200-watt gasfilled lamp in one of these projectors is claimed to shed materially more light on a given area than a 500-watt lamp in an ordinary lantern will do, which means a saving in current of some 60 per cent.

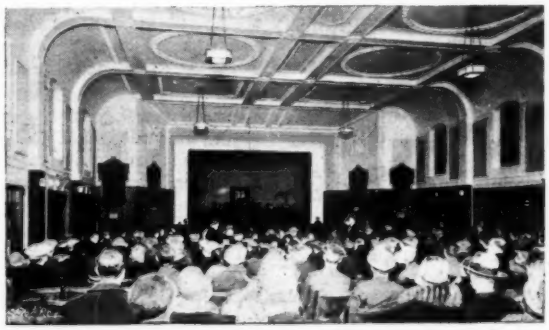
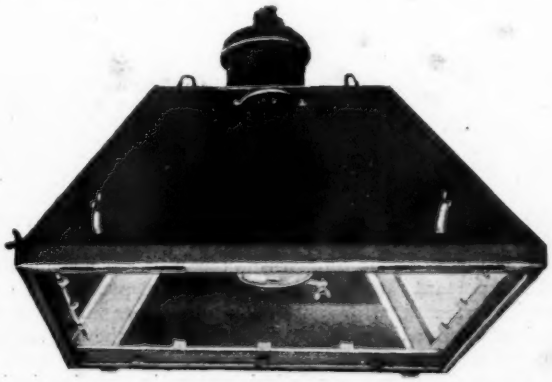


Fig. 1.—Example of Interior Application.

Divisible into two main classes, for vertical and horizontal lighting, the principle on which the projectors are designed is the collection of nearly all the light emitted by a single lamp, by means of a nest of plano-convex lenses, and its concentration on a ring of mirrors so placed round the lamp that they will direct it just where it is required, facile adjustment of each lens and mirror individually providing for correct focusing. One of the several vertical-projection models is shown in fig. 2. The mild-steel lantern has a hinged door and a hammered-glass front diffusing screen; similar glass can be used in place of the four plain-glass mirrors if extra diffusion is desired. One of the five lenses is suspended directly below the 500-watt lamp in its "Goliath" holder, the latter being adjustable vertically for focusing purposes. Energy economy worth striving for is possible by the use of these lanterns for indoor illumination, fig. 1 being an example of decorative fittings of this type; the photograph was taken at 9.30 p.m. in May last.

The construction of the horizontal projector is indicated by fig. 3; the pressed-steel lantern has back and front hinged doors, their direction of opening being reversible for convenience. The rear door provides access to the lenses and reflectors for adjustment, while the hammered-glass front sheet effects the requisite diffusion. Each of the seven plano-convex lenses is adjustable, and the angle at which light is reflected from any individual mirror may be varied, both in the vertical and horizontal directions. The lantern is so mounted on a trunnion carrier, with a base plate, that it may be rotated in both the horizontal and vertical planes. A position-indicating device, consisting of two brass dials and pointers, can be affixed to the lantern to assist in returning it to its correct setting after it has been moved for cleaning or otherwise attended to.

According to the setting of the reflector mirrors, such a lantern, when containing a 500-watt gasfilled lamp, is capable of furnishing illumination intensities of from 2,500 c.p. (180-deg. beam angle) to nearly 14,000 c.p. (30-deg. beam angle). A pair of such lanterns mounted 30 ft. above ground in an open space will effectively illuminate an area of 15,000 sq. ft. For horizontally lighting large areas the lanterns should be not less than 25 ft. above ground; a pair may be set facing each other



Figs. 2 and 3.—Vertical and Horizontal "Blaizolite" Lanterns.

to light the intervening space, and the distance between them may be as great as 450 yd., depending on the intensity desired, each throwing light down to the foot of its pole with a noticeable absence of heavy shadows.

Fig. 4.—Dry Dock, Night View.

In some positions it may be necessary to screen light from a particular portion of the area served by a lantern, and this can be done by adjusting one or more reflectors while in use from the back without altering the position of the lantern at all; moreover, the light so deflected is not lost, but merely diverted to another part of the area illuminated.

It will be appreciated that these lanterns are specially useful for flood-lighting large areas (for example, pageant and tattoo arenas) railway-truck marshalling yards, docks, and harbours, as the photographs reproduced in figs. 4, 5 and 6 indicate. Messrs. Baxter & Caunter, Ltd., have been responsible for the introduction of these projectors, and for the preparation of the lighting

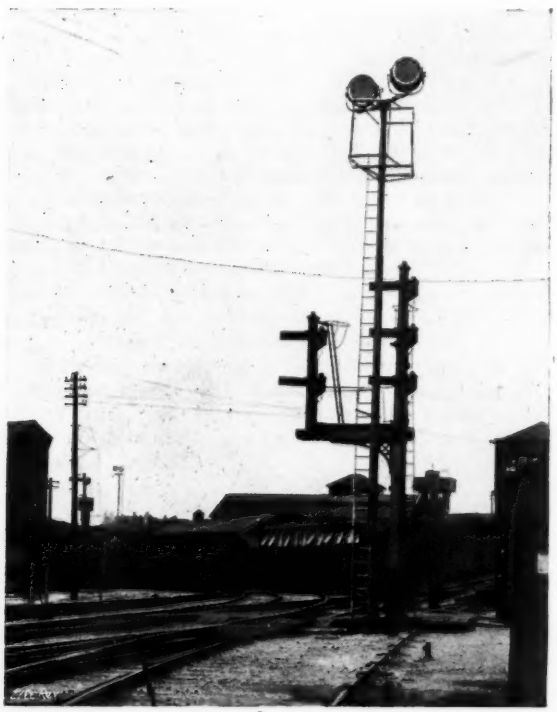
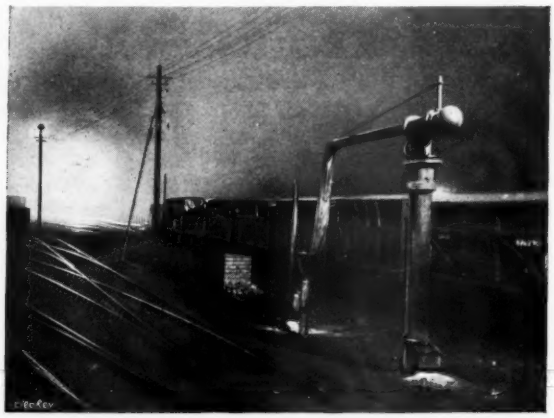


Fig. 5.—West India Dock Sidings by Day.

schemes illustrated. Furthermore, their application to main-road illumination should assist materially in economically avoiding those alternating bright and dark patches which are a contributory factor to many night-driving accidents, whilst the facile focusing arrangement renders them equally suitable whether the road be 20 or 120 yards wide. Properly situated at a height of not less than 25 ft. above the road surface, sixteen type-B.25 500-watt projectors suffice to light one



L.M. & S. Railway] *[Crewe.*

Fig. 6.—Railway Goods Yard, Night View.

mile of straight road evenly without harmful glare and shadows.

It would be unreasonable, of course, to expect more lumens to be measurable on the plane to be illuminated than the given source of light is capable of emitting, but it is contended that "Blaizolite" lanterns do project a greater proportion of the available light where it is most needed than fittings which rely on reflection alone are able to do. The prejudiced alone will describe a wattage of 8,000 per mile of main road as extravagant, and such figures as the foregoing will appeal to all who maintain that arterial highways should, and probably will in time, be provided with sufficient adequately-focussed illumination to render dangerously dazzling vehicle head-lamps superfluous.

Electricity in Mines.

The ninth annual report of the Secretary for Mines, which includes the annual report of H.M. Chief Inspector of Mines, has now been published (H.M. Stationery Office, price 3s. 6d., by post 3s. 9d.). The report contains general reviews, both of the coal mining industry and other mining and quarrying industries. In the review of the coal mining industry some account is given of the prominence taken by the coal industry in international affairs, through the attention given to it by the League of Nations organisation, and in the deliberations of the Young Committee on Reparations and the subsequent conference at The Hague, and also of recent developments in the mechanical equipment of the mines, including the washing and cleaning of coal. There are other sections dealing with wages and profits (including the working of the district wages agreements); the miners' welfare fund; proceedings connected with applications for working facilities under Part I of the Mines (Working Facilities and Support) Act, 1923, and Part II of the Mining Industry Act, 1926; and the more important matters arising out of the general administration of the Mines and Quarries Acts on health and safety questions.

The report of the Chief Inspector of Mines deals with the important question of the causes and prevention of accidents, and with all technical matters which have arisen during the year in connection with the activities of the Mines Inspectors.

There is a full statistical appendix covering both reports.

A report to the Secretary for Mines of the Committee appointed by him to inquire into the qualifications and recruitment of Officials of Mines under the Coal Mines Act, has also been published (H.M. Stationery Office, price 3s. 6d.).

Aero-engine Testing.

Notes on the electric power plant employed for testing aeroplane engines, with reference to layout, practical operation, economy, and other similar details.

By "AERO."

AERO-ENGINE testing in this country has become a fine art. Excepting Germany, perhaps, few other countries appear to have hitherto appreciated fully the proper facilities required for sound precision testing, which is so very necessary in Great Britain to meet Air Ministry minimum standards. The standards are, rightly, high. Life and death are so intimately bound up with the driving member of the aeroplane that the comparatively trivial tests carried out by many foreign concerns and government departments are, to the British engineer, a matter of amazement, justification of which is reflected in accident statistics.

Fortunately the same statistics have now focussed makers' attention on proper test methods all over the world, and as a result electric power plant has rapidly taken foremost place in all aero-engine test shops. The arrangements are comparatively strange to the general electrical engineer, and a number of important points must be taken care of in laying out widely different equipments, otherwise "snags" of a serious nature may unexpectedly crop up and lead to heavy financial loss.

Hence, it will be most convenient to mingle layout details, practical operation, and plant economics in preference to subdividing them, such procedure being thought to be most convenient to the reader who makes acquaintance with aero-engine test plant for the first time.

The main test requirements are that :—

1. The engine must be tested under conditions as nearly equal to working conditions as possible. This involves provision of an air blast equal and similarly disposed to that experienced by the engine in the air. The blast must further be arranged to permit of flow variation, so as to enable the engine to be examined under approximate "climbing" or "banking" conditions. Engine cooling under these conditions, of course, varies appreciably, especially in the tropics, and/or in rarified atmosphere.

2. Provision of adequate means for directing the air blast between the cylinder heads in the manner that air would approximately circulate were the engine in flight.

3. Cooling air pressure and volume must never fall below those minimum values necessary to carry off cylinder heat as quickly as it is generated.

4. Lubricating oil must be maintained at adequate temperature and pressure levels, oil failure of any kind being fatal within a few seconds.

5. Engine shaft inertia being negligible, overspeed may build up rapidly, and must be prevented.

6. The engine must be properly run-in prior to admission of petrol to the cylinders.

7. After petrol cocks are opened, the engine must be held "ticking over" to enable adjustments to be effected; this for anything up to two hours.

8. Load must then be applied until the engine runs at full power.

9. At each stage of the test, accurate power, petrol and oil consumptions must be recorded.

10. Each operation should be as far as possible sequence controlled.

11. Acceleration tests must be taken on each magneto, running alone.

12. The complete test must be economically carried out, *i.e.*, with as little load power used as possible and with as much engine power usefully converted as possible. A 500-h.p. engine will use 95 gallons of high-grade fuel per hour for ten hours or more on end, six engines may be on simultaneous test, while modern practice provides 1,000 h.p. and 2,000 h.p. per engine. The cost of testing fuel alone is therefore vast, and electric power return is absolutely essential.

At first sight it would appear that by merely mounting the engine, with its propeller fitted, on a torque-reaction stand, and running it round as under flying conditions, all the foregoing points could be attained. Actually, this method was regularly used, but the matter is not so simple as might thus be implied, and the arrangement is now largely confined to testing propellers only. Without going into detail much beyond that of electrical interest, it may be taken that the rig-up mentioned far from represents actual flying conditions. The propeller "slip stream" entails a definite and variable force upon the torque stand, depending on the propeller speed, and this reaction quite falsifies the power readings obtained. Also, since the engine is run at speeds much below minimum speeds arranged for after it is fitted to the aeroplane, in order to effect proper initial tuning, the available air blast from the propeller is insufficient to prevent the engine overheating. Further, running-in must be done under petrol, which procedure is now considered to cause far too much wear and tear on the engine. Recent investigation has indeed disclosed that some hitherto unsuspected improper conditions are actually imposed upon the engine by such running-in, especially with axial cylinder engines. The point is more fully detailed later.

Air Blast Arrangements.

Proper air conditions can only be secured by mounting the engine close up to the mouth of an air tunnel, the orifice of which is adjustable to differently shaped cross sections at will, so as to be intimately close to the cylinder heads without actually shrouding any portion of the engine. The nozzle usually takes the form of a stout calico cylinder, having one end clamped to the tunnel proper, and the other to a specially shaped adaptor designed to suit the air flow required by the engine under test. The tunnel varies from 3 ft. to 6 ft. in diameter, and it may be erected overhead or underground. It must be of sufficient length to accommodate beneath or above it the running-in and loading apparatus, and it must contain a low-pressure switch, of the balanced flap type, designed to make a relay control circuit by the movement of a flap suspended from a ball-bearing spindle. The flap drops immediately the wind pressure falls, revolving the spindle, at the end of which contacts are made by the turning movement. The master relay is then actuated to earth the engine magnetos and so shut the engine down. The relay is a master for other protective switches mentioned later. Further, the tunnel must contain a damper, which has some electrical importance, and the damper action must be slow, especially in a.c. schemes.

Overhead tunnels are of boiler plate, while underground arrangements are of smooth surfaced brick or concrete. Each construction features different air constants, which reflect upon the necessary fan to provide the air blast, and therefore upon the fan prime mover. Since the necessary air volume varies from 10,000 cu. ft. up to 200,000 cu. ft. per minute, and the air velocity from 90 m.p.h. up to 200 m.p.h., it will be appreciated that the fan design is quite a specialised matter, the more so as air flow in large tunnels differs radically in characteristics from air flow in short length, or small diameter, ducts, with which electrical people are more familiar. Similarly, the fan inlets, both single and double, depending on the size of the plant, require great care in designing. On no account must heated air from other test benches, or fine atmospheric grit, be permitted to enter the air blast, while the ejector effect of the heavy concentrated blast in the centre of the test-house cross section must also be carefully considered. Hence, each test plant is housed separately, possesses its own inlet, and has its own fan motor.

Fan Motors.

No two fan makers will quote identical powers for given air output conditions of ordinary dimensions, and so with these special arrangements, necessitating as they do designing with respect to the complete combination and lay-out of all the units involved, together with the test house into the bargain, it will be appreciated that the divergence between various makers' figures is wide. However, in general, fan motors are required from 90 h.p. nominal rating at 750 r.p.m. up to 1,000 h.p. at 960 r.p.m. for the largest sets at present called for. Each machine must develop full horse-power at 100 per cent. speed down to 85 per cent., below which the output will fall off cubically down to 55 per cent. speed, such ratings being expressed from the fan makers' viewpoint. Electrically, they mean d.c. motors rated to develop full power at bottom speed, a.c. slip-ring motors to run below rated full load at top fan speed, and a.c. commutator motors which can be rated for only that power which would be necessary were the torque curve a straight line.

The d.c. motors, with their control gear, are usually lowest in capital cost. The special fans do not often lend themselves to a.c. speeds for maximum efficiency on the average run of testing, which may, where several different engines are manufactured, be such as to require about 80 per cent. of full fan output. D.c. lends itself to motor speeds very near to actual required speeds, and so to economical running, especially since the necessary speed variation is obtained by shunt control. D.c. motors must be compounded, both for top speed stability and for overload protection. The cubical fan power characteristic, acting in conjunction with compounding on the motor, provides an automatic stabilising arrangement in the event of any air hunting working its way back on to the motor. Slip-ring motors must be series controlled, and a slip-ring motor running at 80 per cent. speed under fan characteristic entails a power loss of 13 per cent. of the total full-load input to the machine when being used for the general run of testing in the shop. This represents a serious item in the annual power bill, and may become even more so if power is charged on a power-factor-rebate basis. The same motor may drop its power factor by 10 per cent. or more under such conditions (see *Journal*, I.E.E., Vol. 66, p. 790, for an exposition). This last is also a limiting factor in instances where generating plant must be put down specially for the aero-engine test house.

A.c. commutator motors were, therefore, at one time favoured for the purpose, but they had to be abandoned on account of high price, output limits, and inherent "hunting" speeds. The last were found to coincide with the required average testing speed, while the present 300 h.p. (approx.) output limit is now useless to meet up-to-date air blast power requirements.

A further alternative lay in the use of a slip-ring motor directly coupled to, and fed by, a frequency converter. Such arrangement obviated the foregoing power losses, and certain control-gear difficulties to be yet mentioned respecting the plain slip-ring machine. Unfortunately the capital cost amounted to nearly 40 per cent. of the cost of the total test plant, excluding buildings and engine loading arrangements to be yet discussed, while the length of the complete machine complicated matters seriously. Each plant being housed in its own building for the reason above, the long frequency converter necessitated a wide building, together with a resultant awkward kink in the shape of the large wind tunnel, involving heavy financial extras, so that the arrangement became as unwieldly as the installation of a d.c. motor fed *via* a motor-generator or rotary set, similarly disfavoured.

Illogical though it may appear, it is the case that the average purchaser of these equipments hardly appreciates the loss of power which must take place in the a.c. fan-motor control gear, as compared with the power which may be saved by employing an electrical dynamometer for the loading arrangement. Concentration is effected on what can be saved at the engine end, with complete disregard of what may be lost at the fan, irrespective of whether the output of the dynamometer may be utilised or not. This peculiar mentality is often difficult to understand.

Fan-motor Control Gear.

The alternatives of liquid or metal resistances for the a.c. controller must be considered. The liquid type provides the best all-round arrangement, especially in view of the continual tendency to higher-powered plant. Infinite speed variation, between the working speed limits, is available, and the fan may be held at just the correct air blast required. The regulators must be of the negligible-evaporation totally-enclosed pattern, as they are frequently required to operate for one hundred hours on end. On experimental engines longer test periods are the rule. A difficulty lies in cooling water consumption, which may in certain circumstances prove to be a serious item, most aerodromes, by virtue of circumstances, being distant from large water supplies.

A liquid controller for a 500-h.p. motor may require 20 gallons per minute if operating at maximum speed variation continuously Water-cooling plant may be found to be compulsory. Its size, however, is bound up with the types of engines to be tested, and also whether the loading apparatus includes a water brake or not. If air-cooled engines only have to be tested, then water-cooling plant will require to be only of a capacity sufficient to cool the controller and the water brake, but the relative cost of these items and the apparatus to be cooled may appear disproportionate. Should both air- and water-cooled engines be tested, then water-cooling equipment of large dimension must be installed as a matter of course, and allowance for cooling the controller is easily made. Nevertheless, the tendency to larger sets now calls for larger liquid controllers, and these unfortunately take up a large amount of valuable floor space. A controller to dissipate 100 h.p. continuously is an inherently bulky piece of plant, independently of its circuit-breaker, which, if of the high-pressure high-rupturing-capacity pattern, is also large. Accordingly there is a tendency now to force-cool the controller by a small motor-driven circulating-water cooler integral with it. This affects marked reduction in size, while the water taken from the main need only be sufficient to make up evaporation losses. Overall cost remains much as before. An important point is, however, that with such an arrangement it is essential, besides providing the controller with an interlocking switch circuit to its main breaker, to interlock the switchgear for the cooler motor with the main breaker in the same manner. Before the main breaker can be closed, first, the cooler motor must be running, and, secondly, the controller blades must be in the "all resistance in" position.

(To be continued.)

Electricity Supply Progress.—III.*

The Problem of the Capital Charges incurred in Transmission and Distribution.

By R. S. H.

ATTENTION has already been drawn to the fact† that during the last seven years the average capital charges on transmission and distribution systems throughout Great Britain have steadily risen from about 17 per cent. to over 27 per cent. of the revenue from the sale of current for the year in question. Such charges have thus become the most important item in the cost to the final consumer, and it is worth while giving consideration to the question whether these costs can be reduced in any way or their incidence counteracted either in total or per kWh sold.

Of course, it will be appreciated that the figures quoted are only averages. Without doubt a smaller proportion than 27 per cent. of the total costs of high-pressure energy and a larger proportion of the costs of low-pressure energy are attributable to capital charges on transmission and distribution systems. Unfortunately, with the information at present available it is not possible to work out any figures, but one ventures to suggest to the Electricity Commissioners that an analysis of distribution capital expenditure between that for high-pressure systems and that for low-pressure systems (*i.e.*, step-down transformers and mains) would be of more interest and use to many of us than the present subjective analysis between land, buildings, plant, &c.

The first aspect to which attention must be given, with a view to reducing these costs, is that of the original capital cost of transformers and conductors. Standardisation of transformer and switch voltage ratios and capacities (as advocated with regard to rural systems in the Electricity Commissioners' recent general memorandum) should tend to reduce costs in these directions, as they facilitate mass production, and in this connection the work of the Overhead Lines Association is worthy of strong support. With regard to the cost of conductors, it is most strongly felt that many engineers are too often inclined to put down underground mains where investigation would show that the much cheaper overhead line would be at least equally suitable from a technical point of view, and that with a little thought local amenities need not be harmed. The writer has often wondered why it is that full domestic supplies are not given more often in town residential areas from overhead lines or cables suspended from the walls of houses; the Post Office uses overhead lines in such residential districts, and in country villages domestic supplies are given from overhead lines—why not in towns? Many at present scheduled on the Commissioners' map as within the area of supply of an authorised undertaker might then have reasonable hopes of a supply within a few years. Some economy in original cost, as suggested in the Commissioners' memorandum, is no doubt obtained by the use, as far as possible, of ring mains, although doubtless more substantial advantages are the greater reliability of supply, the better voltage regulation, and the flexibility as regards geographical distribution of load afforded by ring mains.

When the capital cost, and thus the capital charges, on the distribution system has been brought down to a minimum, the next thing is to make the maximum possible use of the system, thereby bringing down the average capital cost per kWh sold.

With this end in view, every effort should be made

(1) to obtain the maximum number of consumers per unit length of conductor;

(2) to develop the maximum number of uses of electricity with a view particularly to raising the load factor of individual consumers.

On these points also the Commissioners' memorandum, to which reference has been made, is, as far as it goes, an excellent guide. To attain these ends

(1) electricity must be available for all purposes at a competitive cost;

(2) possible consumers must be fully informed of the facts; and

(3) their connection to the system must be vigorously sought and facilitated.

As postulated in the official memorandum, there must be available for domestic supplies (and these notes hereafter apply particularly to domestic consumption) suitable two-part tariffs for normal supplies and a special tariff for "off-peak" or long-hour consumption, such as water heating. In this connection there is some slight deficiency of authoritative information which could fairly easily be made available. Much has been heard of the high diversity factor of heavy-current consuming domestic apparatus, such as cookers, but the writer has seen no extensive sets of figures relating to this very important matter. It will be readily understood that from the electricity supply point of view the cooking load is much more attractive (or can be more cheaply accepted) in working-class districts where the day's heavy meal is taken at mid-day than in districts where a similar meal is taken only in the evening, such that in winter the load overlaps the lighting load. Could not a few engineers with well developed districts offer some figures as to hour by hour and week by week load on sub-stations attributable to definite capacities of apparatus connected? Further information as to diversity between different sub-stations would also be of interest and use. Then, again, it would be of great value to have from authorised undertakers the revenue and kWh sold per consumer under each type of tariff, and full details of the tariff, with a view to observing those tariffs which fail to attract custom and those which are not remunerative to the undertaker; an extension of the official statistics in these directions might be possible.

It is important to bear in mind that the cost of electricity at the meter is not the only factor possible consumers have to consider in deliberating as to whether electricity shall be adopted. Another important factor is the cost of the apparatus on which the electricity is to be used; it is the sum of the cost of electricity and the cost of apparatus which is compared with the corresponding costs of alternatives, such as gas or paraffin. Consequently attention must be given to the cost of apparatus, and in this connection the efforts of the I.M.E.A. and others to evolve a satisfactory standard cooker is also worthy of strong support. As with most industries, standardisation in any direction, where it is possible, tends to reduce costs, as it permits of mass production, manufacturing for stock, and inter-

* For Parts I and II, see ELECTRICAL REVIEW, August 22nd and 29th, 1930.

† Article No. II.

changeability of apparatus and spare parts, and tends to give a wider market. In this connection the writer regrets to see in the Commissioners' statistics that a certain new electricity supply undertaker, in order to operate a large area of supply of some 3,000 sq. m., has decided to adopt a low-pressure distribution system at 410/235 volts, instead of the standard 400/230 volts. It is to be hoped that there is a very good reason for this slight departure from the standard, or, alternatively, that if there is not a good reason that it is not too late to adopt the standard voltages.

As regards the information of possible consumers, there must be propaganda as to the uses of electricity supply through showrooms and demonstrations, and through advertisements and handbills. Further, it is not sufficient that there should be a good knowledge of the uses of electricity—there should be equally good knowledge as to what it costs. Many people still look on electricity as a luxury, even in areas where it is definitely cheaper than substitutes for such purposes as cooking. Undertakers should broadcast the cost of supplies in their areas for each particular purpose, care being taken that the figures do not underestimate the actual normal cost.

As regards obtaining consumers, there must be adopted an active and sustained canvassing campaign; the inertia of some authorised undertakers at the present time is really painful—a new consumer or additional apparatus is connected only if the consumer is determined on it and goes to the length of writing to the undertaker on his own initiative. As indicated in the Commissioners' memorandum, a deterrent to would-be consumers is the high cost of wiring and apparatus, for which many people are unable or are not prepared to pay out a single heavy sum immediately on connection to the electrical system. To avoid this there should be instituted schemes for the provision of wiring and apparatus on hire or hire-purchase; these must be accompanied by a very efficient maintenance system, for it will be readily seen that a few spoiled Sunday dinners due to burnt-out elements (or any other reason for that matter) will quickly lead to a slump in electric cooking.

Electricity for the Home.

Selected Manufacturers' Items; All-electric Houses Costs.

A New Fire.

The "Solray" 2-kW fire, fig. 1, the latest production of ELECTRICAL UTILITIES, LTD., Tudor Works, Park Royal, N.W.10, is provided with two separate refractories, each loaded at 1 kW. These refractories are mounted side by side, and are tilted in an upward direction sufficiently to prevent the heat from damaging the floor, carpet, or lino. The "Solray" fire was designed especially with a view to providing a high-grade 2-kW fire which could be sold at a competitive price for hiring-out purposes. Great care was bestowed on the design of the casting, and the completed design was submitted to several artists of repute before it was put into production. It will be seen that the lines are flowing in their effect, and there is a pleasing absence of "Victorian" decorations. The vertical clamp bar shown between the two refractories is the means whereby the chromium-plated fire guards are fastened to the frame, and this clamp adds to the artistic effect. Finished in high-grade vitreous enamel, this fire should prove a welcome article, especially as every part is claimed to be of British manufacture. The castings are provided by Messrs. John Harper & Co., Ltd., who also do the vitreous enamelling. The refractories are made by Messrs. Geo. Bray & Co., Ltd., and the resistance wire carries the guarantee of Messrs. Henry Wiggin and Co. as being free from all impurities and equal in quality to the best that can be provided.

Fig. 1.—The "Solray" 2-kW Fire.

Specially Designed Cooking Utensils.

MESSRS. HAGUE & MCKENZIE, LTD., Pyramid Works, Sloane Street, Parade, Birmingham, have marketed a range of "Pyramid" aluminium cooking utensils specially designed for use on electric hot plates. The utensils are manufactured with very thick bottoms which are scientifically ground, so as to give an even thickness and a dead-flat surface. It is also claimed that the construction is such that distortion is practically impossible, and that the contact with the hot plate is so good that food will simmer for over half an hour after the current has been switched off. Other points featured in the Company's descriptive booklet are: each handle is insulated and has no screws to come off; no rubber washers to wear out; no wood to crack or warp.

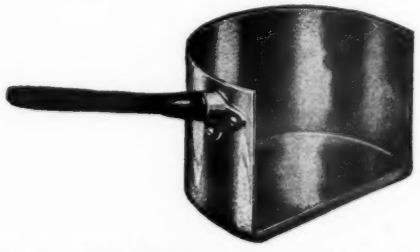


Fig. 2.—Half Section of "Pyramid" Pan.

Fig. 2 depicts the construction of a "Pyramid" pan from which the following results are claimed to have been obtained when using it with an 8¾-in., 2,000-W hot plate: three pints of cold water, starting from cold plate, boiled in 10 min. 0 sec.; three pints of cold water, starting from heated plate, boiled in 4 min. 30 sec.; the water remained boiling after the plate was switched off for 17 min. 30 sec.

A Bathroom Heater.

We illustrate in fig. 3 the "Cromaloy" bathroom heater recently introduced by Messrs. A. C. SCOTT AND CO., LTD., "Cromaloy House," 39, City Road, Manchester. The body is of white vitreous-enamelled cast-iron, and measures 13¾ in. by 8¾ in. by 2⅛ in. deep. The element consists of high-quality "Cromaloy IV" wire wound on a refractory tube mounted in front of a parabolic aluminium reflector. The outer casing is insulated at the back by 3/16-in. thick "Sindanyo" board. Efficient earthing arrangements are provided, and the heater is supplied with two yards of 3-core

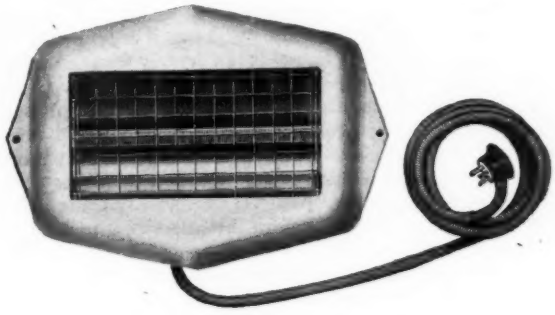


Fig. 3.—"Cromaloy" Bathroom Heater.

flexible lead and a 3-pin plug. All the current-carrying parts are protected from accidental contact by a stout wire guard. The standard model is loaded at 500 W.

A Portable Tubular Radiator.

Although a demand exists for the present-day types of decorated electric fires, there are certain situations demanding other than standard equipment, and to satisfy such requirements "Maxheat" tubular electric radiators were designed and produced by the WARDLE ENGINEERING CO., LTD., Old Trafford, Manchester. The tube is mounted in a cast-aluminium frame, the top portion of which forms the carrying handle. The compact design ensures the emission of the maximum heat at floor level, the ideal position, it is claimed, for convection heating. The latest development in this range is the "Maxheat Multibar" radiator, fig. 4, which consists of three "Maxheat" tubes, each loaded at 750 watts, mounted into a cast-iron frame, the top portion of which forms the carrying handle. Each tube is arranged for 3-heat control, a reciprocating rotary switch being fitted on the left-hand supporting bracket. The standard finish is a rich black enamel. The element comprises a number of fireproof porcelain units, each having four projecting arms, threaded on a steel core of square section. The nickel-chrome-alloy spiral is threaded in and out of the recesses formed by the projecting arms, and is held rigidly in position, no part of the surface being enclosed. The terminals are completely shrouded in a porcelain block, the terminal wiring connections being of beaded flexible wire. The

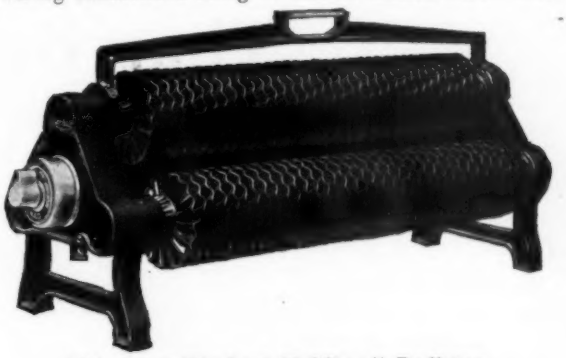


Fig. 4.—"Maxheat Multibar" Radiator.

construction is such that the element can be withdrawn as a complete unit.

"All-Electric" Houses Costs.

In his presidential address before the Engineering and Scientific Association of Ireland recently, Mr. A. G. Bruty, M.I.E.E., according to *The Irish Times*, dealt with the question of domestic electrification and gave some interesting figures of costs which he had collated. The accompanying schedule shows the equipment installed in, and the cost of running of, "all-electric" houses in three important areas.

The probable cost of the equipment set out was as follows:—

House Ratable Value.	Value of Equipment.
£19	£26 0 0
£29	£30 0 0
£65	£40 0 0
£150	£90 0 0

From Liverpool, said Mr. Bruty, he had received details of a housing scheme of 256 "all-electric" six-room houses. The equipment in each consisted of a 2-kW fire, a 1-kW fire, a 7½-kW cooker, and a 1-kW immersion heater thermostatically controlled. The annual consumption per house averaged 6,941 kWh. The tariff was a two-part one, 1s. 6d. per week standing charge and ½d. per kWh charged through a shilling slot meter. The cost to the tenants, therefore, was £18 7s. 2d. per annum (0.64d. per kWh). Assuming a £15 valuation for such a house, the cost for the Dublin area would be £21 11s. 8d. approximately; Greater Dublin area, £32 16s.; Wexford, £60 8s.

A house in Sheffield consumed 7,561 units per annum at a cost of £21 8s., which worked out at about 0.68d. per kWh. The Sheffield tariff was a two-part one, and consisted of a standing charge equal to one-twelfth the ratable value, plus ½d. per kWh. The ratable value of the houses appeared to be very high in Sheffield, and in order to make a fair comparison he had taken the valuation of a house of similar size in Dublin. The comparable figures then became:—

Sheffield	£21 8 0
Dublin area	£24 15 6
Greater Dublin area ...	£36 14 1
Wexford	£60 10 2

Ratable value.	Equipment.	Units consumed.	Consumption costs. —	Dublin area.	Greater Dublin area.	Wexford.
£19	Two 2-kW fires, one 1½-W fire, one 600-W fire, one 7-kW cooker, one iron, one ½-kW immersion heater (in use 24 hours a day).	5,976	£17 1 0 (0.68d. per unit).	£19 3 4	£27 16 0	£54 0 0
£29	Three 2-kW fires, one 7-kW cooker, one iron, one 3-kW, 3-heat immersion heater.	9,441	£25 12 4 (0.65d. per unit).	£29 19 0	£44 10 9	£85 3 6
£65	Three 3-kW fires, one 2-kW fire, one 1-kW fire, one 7-kW cooker, one 3-kW immersion heater, one 1-kW immersion heater, one iron.	14,894	£42 3 10 (0.68d. per unit)	£50 10 10	£71 16 2	£130 12 4
£150	Three 3-kW fires, two 2-kW fires, four 1-kW fires, one 9-kW cooker, one 4-kW griller, two 3-kW immersion heaters, one ½-kW immersion heater (in use 24 hours a day).	28,306	£76 16 3 (0.65d. per unit).	£97 16 7	£117 18 0	£242 7 8

That Better Job!

A Hint to Get It.

By A CORPORATE MEMBER.

THE vexed question of the electrical man's personal prospects and remuneration will, presumably, never be one hundred per cent. settled; to some, doubtless, not even fifty per cent. settled. Which circumstance is therefore taken as excuse for what follows: an attempt to illustrate a generally unsuspected sequence of circumstance from actual experience.

Following the last disastrous coal stoppage, an assistant manager with an electrical manufacturing firm lost his position. His experience had travelled the gamut from shop apprentice, through foremanship, chief draughtsmanship, to electrical designer and assistant manager, professional status having been gained the while, by patient study, experience and examination. Circumstances grew to the hardness any familied married man dreads, and were only relieved after some months of continual job application, by the offer, and acceptance, of a routine production draughtsman's position in a large electrical concern, at a low salary. Improvement imperative, the applications were continued, and in due course, over a period of three and a half years, thirteen different positions were actually discussed at interviews. These are set out below as nearly as possible in the order in which they eventuated, the salaries stated being the actual figures offered by the firms concerned as against much higher figures asked:—

1. Routine draughtsman, large electrical manufacturers' motor department 250 h.p. £247 p.a.
2. Assistant sales engineer, competitive a.c. motor firm, branch. £200 p.a., ½ per cent. commission.
3. Senior assistant a.c. designer, ditto, works. £250 p.a.
4. Assistant sales engineer, electrical ventilation specialists. £312 p.a.
5. Contracts engineer, medium electrical manufacturers, plant to 2,500 kW. £350 p.a.
6. Assistant sales engineer, large electrical manufacturers, branch. £260 p.a., 1 per cent. commission.
7. Assistant editor, technical journal. £300 p.a., removal allowance.
8. Designer draughtsman, medium electrical manufacturers. £260 p.a.
9. General electrical designer, medium electrical and mechanical engineers. £300 p.a.
10. Chief electrical engineer, large Indian general engineers. £450 p.a., passage.
11. Chief draughtsman designer, small a.c. motor manufacturers, non-competitive. £364 p.a.
12. Area exhibition manager, large electrical manufacturers. £264 p.a.
13. Chief electrical sales and design engineer, medium size mechanical engineers. £380 p.a.

The salary figures do not, however, tell the whole story. Indeed they convey, *primâ facie*, ideas that are distinctly fallacious, for in any job five main factors must be weighed up, *viz.*, (*a*) Actual £.s.d. guaranteed, (*b*) extras that may accrue, (*c*) overtime involved, if any, (*d*) congeniality, (*e*) cost of commencing. While the money guaranteed brings obvious ideas to mind, the question of possible extras needs consideration. They may, in the main, be regarded as (*f*) definite commission, plus (*g*) a sum covering the benefits (sic) of expenses. Not for a moment is it suggested that all expenses result in financial increase; far from it. Although most firms of standing recognise that some small compensation is allowable in respect of continual absence from home, there are many who hold a radically different point of view. Hence the former may be recognised by an apparent increase in salary of £20, while the latter may easily cause the effective salary to decrease by the same sum.

However controversial it may be, overtime exists, in fact, and must be regarded by the salaried man as a loss. The man "on the road" knows only too well how much loss it can mean on occasion, while the man in the office gets his spell of it during the rush seasons. Generally, no holiday period can be set off against it in addition, and therefore, in weighing it up financially, to reduce the salary figure to an hourly basis, is quite fair on the basis of a normal 42-hour week.

Congeniality is difficult to reduce to pounds and pence. It largely depends on worry, and worry about most jobs centres round (*h*) permanency, and (*i*) immediate prospects. Permanency again depends as much on the employé as upon the firm. The man who "sticks" a position known or suspected to be temporary, until the inevitable happens, must face the consequences, however cruel the fact may be. Hence, permanency can only be reduced to a financial basis if the position carries a pension or superannuation scheme with it. In such cases £30 might be taken as a representative extra upon the guaranteed earning per annum. Prospects, on the other hand, as regards rapid salary increase, diminish where a pension scheme is in vogue. In such instances, the "dead man's shoes" sentiment comes to the fore with a certain force; so that while an equivalent decrease in the circumstance can hardly be justified, neither can any further increase. In any case the instances are few where immediate prospects can be assessed at a relative value of more than £15 per annum increase.

The cost of commencing a new position is frequently serious. The successful applicant may have to change his home four hundred miles—no light matter. Few firms admit any liability in this respect, while those who feel disposed to do so rarely will exceed the costs equivalent to 100 miles transport, say an average of £21; which amount should be spread over three years as being the maximum reckonable time by which the new man will have arrived at a true estimate of the position's potentialities. Similarly, if the employé must pay, his cost should be split also; the first being additive in fixing the relative value of the job, and the last deductive. For the purposes of comparison the 100-mile journey is considered common to all the positions stated except No. 10, as in any case it would have been a fairly true circumstance.

Other factors of more particular nature, of course, enter into consideration, and in the "corrected" outline of the cited positions as below, such factors are stated where applicable:—

1. Superannuation scheme after 3 years; poor prospects; no overtime; no removal allowance; +£30−15−7; net £255 p.a.
2. Guaranteed commission £40 p.a.; 5s. weekly loss on expenses; poor prospects; 55-hr. week; no removal allowance; +£40−13−75−7; net £154 p.a.
3. Permanency strictly dependent on trade; 48-hr. week; routine without prospects; no removal allowance; −£15−50−15−7; net £158 p.a.
4. Guaranteed commission £45 p.a.; good expenses; pension; 50-hr. week; no removal allowance; +£45+20+30−78−7; net £322 p.a.
5. Good prospects; 46-hr. week; limited expenses; no removal allowance; +£15−52+10−7; net £316 p.a.
6. Guaranteed commission £60 p.a.; 50-hr. week; permanency; poor prospects; poor expenses; no removal allowance; +£60−65+15−15−5−7; net £243 p.a.
7. Normal hours but part night; fair expenses; permanency; moderate prospects; removal allowance; +£15+15+5+7; net £342 p.a.
8. Routine, no overtime; permanency; moderate prospects: technical literature gratis. £21/3; no removal allowance; +£15+5+7−7; net £280 p.a.

9. Routine; poor prospects; permanency; no overtime; no removal allowance; −£5+15−7; net £303 p.a.
10. Fare and leave, £120/3; medical attendance, £20; permanency; good prospects; no clothes allowance, £60/3; good expenses; 35-hr. week; no removal allowance; half wife's fare, £60/3; wife's outfit cost, £72/3; cost of living=total 1.6; (±£60+20+24+24−20+48±56−100−20−24) 1.6; net £324 p.a.
11. 60-hr. week; tea allowance; heavy responsibility in firm without system, resulting medical attention; pension; poor prospects; no removal allowance; −£120+19=10+30−7; net £276 p.a.
12. 65-hr. week; expenses very good; pension; small commission; poor prospects; no removal allowance; −£100+50+30+20−15−7; net £242 p.a.
13. 46-hr. week; expenses very good; insurance scheme; co-operative purchasing benefits; fair prospect; permanency; no removal allowance; −£50+50+10+20+10+15−7; net £418 p.a.

The reader will doubtless modify the foregoing in accordance with his own particular experience. On the whole, the final figures arrived at may seem to many to be on the low side, as indeed they may be found from the rough check taken later. But the *relative* values are reasonably accurate, as the writer has reason to know from experience, and for the present purpose the relative values are of major importance.

The rough check can be taken by considering the average of all the " corrected " salary figures. This is found to be £279 per annum. Some time back the Society of Technical Engineers published an average salary table of *all* engineers with remuneration between £150 per annum and £1,200 per annum. The mean figure came out at about £660 per annum, quite an appreciable drop from the maximum individual figure. The increase from mean to maximum is 80 per cent. with the S. T. E. figures and 50 per cent. with the present figures, which, having regard to the more limited basis of comparison, is somewhere near what might be expected.

The next step is to classify the positions in the generally accepted order of " status," that somewhat indefinite idea that most applicants have in mind when weighing up whether to apply or not for the particular position drawn to attention by advertisement. One should not be too dogmatic about this point, but the following is thought to be a fairly representative classification. The average salary applicable is placed opposite each position as discussed:—

A.	1. Draughtsman. 8. Designer draughtsman.	£253; corrected £265 p.a.
B.	2. Assistant sales engineer. 6. Ditto. 12. Exhibition manager. 4. Assistant sales engineer.	£260; corrected £238 p.a.
C.	3. Senior assistant designer. 7. Assistant editor. 9. General electrical designer.	£284; corrected £251 p.a.
D.	5. Contracts engineer. 10. Chief electrical engineer. 11. Chief draughtsman designer. 13. Chief electrical sales and design engineer.	£387; corrected £359 p.a.

The classification is not complete, however, as it takes no account of the type of firm corresponding to each type of position. It is more convenient to deal with this later.

One of the peculiarities supported by the classification lies in the experience of the originally humble office aspirant after he has successfully climbed out of the groove into Class B. All such men known to the writer pass, or have passed, through the same experience, namely, that, although the new position marks in cash received an advance upon the previous one, in actual fact the new salary does not " go so far " as its predecessor; not by a long way! The wider sphere of activity carries more personal monetary responsibility in proportion than does the more lowly inside job.

While it is possible, and indeed quite usual, for one to pass from Class A to Class C without touching Class B, it is equally recognised by most that the properly trained senior man provides himself with outside experience as a matter of personal duty. It is unfortunately too true in these days that the " office mind " of the man who has never been outside in his life is one of the bars to commercial progress in any sphere, and in course of time (maybe sad time) the man who has gained the wider outlook has sound reason to thank his stars that he went through it. Even so, the immediate gains only bring one back to approximately where one commenced; which point, it is suggested, has been the unconscious and unsuspected cause of much acrimony in letters to the editor of any journal which, like the ELECTRICAL REVIEW, has the welfare of its readers much at heart. How often has one read, or known, of really fine characters, who, having occasion to look back and make comparisons, raise hands to Heaven and wonder if the game's worth the candle! Mayhap the reason is really indicated here!

It might be worth mentioning that up to this point, the single man is the better off. The married man must, under present salary adjustments, be content with the same cash, but decidedly harder cash, and make effort to reach the next class of position, in which, it may be reasonable to assume, the majority of employés are married men. The salary increase is relatively large in the general sense, while the responsibilities are such that men of at least 30-35 years of age with wide outlook are required. The difficulty is, however, that the class in itself is relatively small, and does not apparently offer many openings; certainly not in the electrical line in view of the continual tendency to large firm amalgamation. This leads to the classification of the types of firms at present under notice:—

	Type of firm.	Average un-" corrected " salary.
AA.	1. Large elect. mfrs. 8. Med. elect. mfrs. Both competitive.	£253 per annum.
BB.	2. Comptve. a.c. mfrs. 4. Elect. ventln. spects. 12. Compet. elect. mfrs. 6. Ditto.	£260 per annum.
CC.	3. Compet. a.c. mfrs. 7. Techn. journal. 9. Med. elect./mech. engrs.	£284 per annum.
DD.	5. Med. elect. mfrs. 10. Large gen. engrs. 11. Sm. non-comp. elect. mfrs. 13. Med. mech. engrs.	£387 per annum.

It will be observed that AA and BB comprise firms which are wholly electrical, with the exception of No. 4; CC contains 7 and 9, firms whose work takes in the entire gamut of electrical knowledge, *i.e.*, not confined to any particular side of the industry, and indeed branching into mechanical engineering. In DD the mechanical engineering aspect predominates.

From which it must be deduced that *the average number of really sound prospective positions, offering the opportunity for advancement so ardently desired, falls to a low value in the electrical trade considered alone, but rises to a " sporting chance " figure when the applicant is prepared to cross over to the mechanical side of the industry.* From one point of view, such a state of affairs is truly deplorable, but, from the wider aspect, the circumstance is perfectly logical. There is to-day, between the mechanical and electrical sides of engineering, an out-of-balance, as regards development. With few exceptions, where electrical equipment has replaced mechanical gear, the new installation possesses one tithe of the size, and affords all-round economies, the true value of which have only been fully appreciated within recent years. Hence there has been a relatively sudden expansion of electrical engineering along definite lines, until, generally speaking, most of the purely unit work has been taken over by electrical equipment. Mechanical firms, thus dispossessed of the prime mover side of their activities, have been obliged to concentrate upon speciality work which will be able to operate in conjunction with *any* form of prime mover. Yet again, as main contractors for complete installations they have been obliged to take responsibility for the complete equipment, prime mover included. Equally, the very necessary recovery of overhead charges demands that as much as possible of the entire contract be manufactured in their own works, with the result that their designs generally are trending back to the incor-

poration of the prime mover portion with the speciality portions of their manufactures. The prime mover this time, however, is of electrical type, about which mechanical firms are, on their own admission, very much in the dark, as the successful applicant in this, the proper direction at the present time, will very soon find out.

Now the very fact of the enforced " speciality " position of the mechanical side of engineering has made it impossible for the huge direct amalgamations which have occurred in electrical engineering to take place among mechanical firms. Financial amalgamations have occurred, of course, but the effect of these, in limiting the type of product of each constituent firm to definite lines as in their electrical parallels, has been almost negligible. Nor is it probable that such will occur for a very considerable time, since the number of mechanical specialities is in itself beyond computation; specialities which must exist in themselves apart from the prime-mover, and with regard to which the direct application of electric power is relatively difficult.

So that, as regards self-improvement, the electrical sphere is saturated, while *that sphere which applies electrical products to its own* is likely to remain unfilled for some time. Thus the aspiring electrical engineer must aim to get away from the purely manufacturing end of the stick, and secure the combination of his electrical knowledge with something else.

A word of warning is, however, perhaps necessary. The combination is most likely to be secured if the applicant's experience has been gained along certain generalised lines, as will be gleaned by again referring to the classification A, B, C, D. A calls for men who appreciate the necessity for accurate routine work, while B calls for men who have passed through the routine stage and have a working knowledge of general economics, a knowledge only gained from hard experience of the other man's trials and tribulations. C calls for routine, economics, and the ability to organise; while D demands ability to effect routine, apply economics, ably organise, and in addition possess adaptability of the widest kind, in order that all the others may be *fundamentally* applied to other and entirely different spheres of activity. If, then, one feels too young, or insufficiently experienced, the obvious course is to *plan ahead* along the path indicated, keeping the end in view throughout the period of plodding. Little, if any, progress can be made, unless one makes serious efforts along a path which is definitely evolutionary in the wide general sense. Which is not a trite academic rule, but a statement of very hard fact!

Flood-water Dispersal.

Jet dispersers which are being installed at the Arapuni (N.Z.) hydro-electric works will each dispose of 25,000 h.p.

(COMMUNICATED.)

THERE are now being installed as an emergency measure at the Arapuni hydro-electric station (New Zealand) two " Glenfield " jet dispersers for 12-ft. diameter pipes, each of which will disperse 25,000 h.p. in the shape of a discharge of water of 3,000 cusecs, that is, about 83¾ tons per second, issuing under a head of 140 ft. The dispersers are believed to be by far the largest yet constructed, and they have been specially designed to by-pass the flood waters of the Waikato River, which are now causing serious erosion.

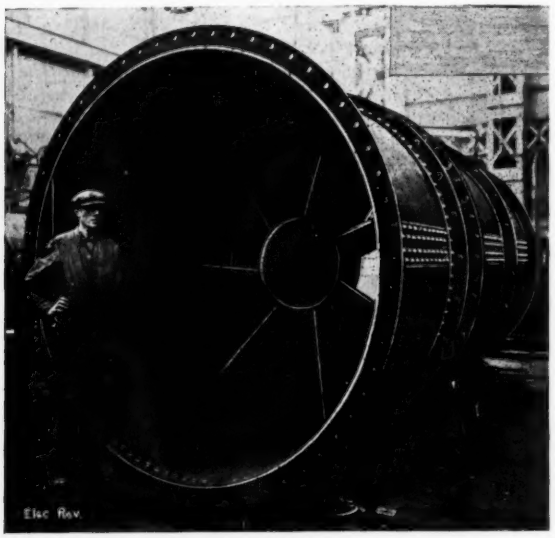


Fig. 1.—Construction of Jet Disperser.

The work is of a considerable credit to British engineering, and we are able to reproduce a photograph, fig. 1, of one of the dispersers in the shops of Messrs. Glenfield & Kennedy, Ltd.

It will be recalled that the Arapuni scheme consists of a concrete dam 192 ft. high across the gorge of the Waikato River, which compounds the water for 18 miles back, and eventually the installation of a series of eight pipe lines, 12 ft. in diameter, leading down to the power station below. At the present time three pipe lines are installed, each serving its own turbine of about 15,000 kW capacity, while the contract for the fourth pipe line and turbine has now been placed. As a result of the backing-up of the river the water is diverted at high level into an ancient channel on the cliff top, abandoned by the river some thousands of years ago, and flows along this channel for about three-quarters of a mile to the forebay and spillway weir, falling over an old waterfall 100 ft. deep into the Waiteti Valley and back to the Waikato River. This is normally intended for the

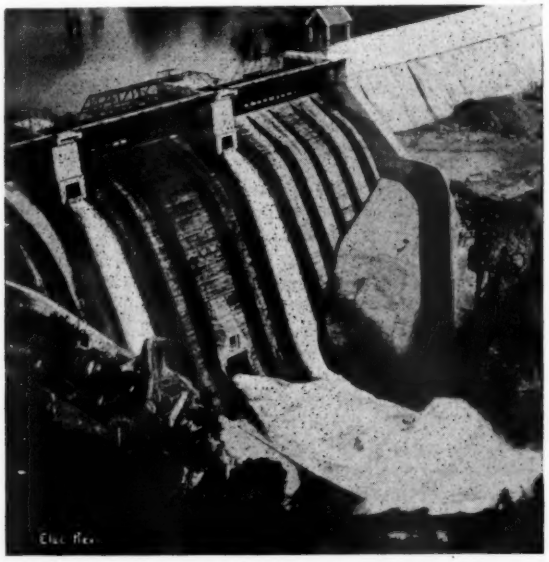


Fig. 2.—Jet Disperser in Operation at Mangahao.

surplus and flood water, or comparatively small volume, the main bulk, of course, passing through the 12-ft. pipes to the power station. The dam and the diversion works have, however, been completed a long time ahead of the power house, and as a result the whole flow of the river has had to be passed along the old channel and waterfall for over 18 months. The normal average flow of the river is 8,000 cusecs, but for many months it has been 12,000 cusecs, and, because of this, serious erosion is taking place. For example, in the middle of 1928 a heavy fall of rock took place at the waterfall, followed by others, and in August, 1929, a huge collapse occurred, so that the fall retrogressed about 200 ft. to a point within 1,100 ft. of the spillway, and further erosion is threatened. In order to take the excess water from the river, pipe lines Nos. 7 and 8 are being hurriedly constructed, and at the end of each pipe there will be bolted, pending the installation of the turbine, a " Glenfield " jet disperser which will allow the discharge referred to without the slightest difficulty. The dispersers taper from 12 ft. diameter at the inlet to 8 ft. diameter at the outlet, and the water will be discharged merely as a vast spray into the river without any ill-effect. This will relieve the situation and prevent any further erosion of the old channel, while eventually pipe lines Nos. 5 and 6 will be also constructed and fitted with dispersers, so that the whole flow of the river will then be taken by eight pipe lines, four fitted with turbines and four with jet dispersers. Then, as the demands for electricity increase, the dispersers will be replaced by turbines as required, the ultimate capacity of the scheme being 120,000 kW.

The dispersers utilise the " free vortex " principle, and the pioneer work of Messrs. Glenfield & Kennedy, Ltd., in connection with their development included the taking of about 150 photographs with one-thousandth of a second exposure. The basic principle is to assist to the maximum degree the tendency of all escaping liquids to form a " free vortex," the principles of which were evolved by Giovanni Battista Venturi (1746-1822) in his famous work (1791) on fluids. For this purpose the disperser is provided with fixed guide vanes designed on correct scientific principles, so that the strong disruptive effect of the " free vortex " is given full scope. As a result, the solid bore of water is broken up into billions of separate drops, which spread over an area of about 150 times that of the original space, and each separate drop is cushioned by the air resistance and the energy thereby dispersed, even when thousands of horse-power are involved, as at Arapuni. Fig. 2 shows a " Glenfield " disperser installed at the Mangahao (N.Z.) hydro-electric works.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures.

An Electrical Hire-purchase Financing Organisation.

A short while ago the United Dominions Trust, Ltd., a concern whose object is the financing of hire-purchase and deferred-payment schemes, formed a subsidiary—United Dominions Trust (Electric), Ltd.—to specialise in schemes relating to electrical plant and appliances. The Electricity Commissioners' Committee upon the hire-purchasing of domestic appliances heard evidence from a representative of the company and the Committee's report has given the matter considerable prominence. In these circumstances interest lies in a booklet just issued by the United Dominions Trust (Electric), Ltd., King's House, King Street, E.C.2, in which the services which it can provide are dealt with in some detail. Plans specially designed to meet the needs of the electrical industry have been evolved. They provide for the payment of a reasonable margin when the goods are delivered, the balance being payable over any period up to three years, according to the type of the goods. The plans are elastic enough to satisfy the special needs of every class of customer. The charges are said to be equitable and are paid by the customer. All the necessary forms are provided. Investigation of the standing of proposed customers is an integral part of some of the plans; in others it is a matter of arrangement. Instalments may be paid either direct to the Trust or may be collected by the manufacturer, supply company, or contractor, according to the needs of the particular case, but the supplier can in all cases, if he so desires, be relieved of all the detail work. All transactions are arranged between the supplier and his customer. The Trust is only interested in the transaction inasmuch as it provides the necessary finance and the company's name does not appear as a party thereto. The booklet sets forth five methods of dealing with the business; these are briefly as follows:—Hire-purchase transactions in which the instalments are collected by (A) the Trust, or (B) the supplier. Plans C and E relate to sales by deferred payments of large and small equipment, respectively, in which the instalments are collected by the Trust. Plan D is a deferred-payment system to provide facilities for municipal and company supply authorities and large contractors in which the instalments are collected by the supplier. These standard plans, it is stated, can be varied to suit the requirements of the supply authorities and other interested parties.

The Lena Goldfields Case.

A decision which may have far-reaching effects was made this week by the Arbitration Court in the case of the Lena Goldfields, Ltd., against the Soviet Government. The company was granted concessions in 1925 to mine in a vast territory, but soon after the signing of the agreement, it was alleged, the Soviet Government interfered with the company in a number of ways, making it impossible for its work to continue. The company therefore asked that the agreement should be set aside, and claimed heavy compensation from the Soviet Government. The Court, from which the Russian representative withdrew at an early stage, found in favour of the company, dissolved the agreement, and awarded compensation amounting to nearly £13,000,000.

Patent Application.

The *London Gazette* announces that an application has been made by Helen Kanders for the restoration of Patent No. 228,905 of 1924, granted to her for " Improvements in sound amplifiers."

Belgian Foreign Electrical Trade.

The following table shows the Belgian imports and exports of electrical machinery, apparatus, and cognate goods during the first half of this year as compared with the corresponding period of last year, the values having been converted at the exchange rate of 175 fr. to the £:—

	Imports. January to June.		Exports. January to June.	
	1929.	1930.	1929.	1930.
	£	£	£	£
Dynamo-electric machinery	355,765	573,215	103,775	150,105
Dry batteries	8,725	11,500	6,925	14,085
Accumulators and parts	24,355	19,900	25,340	29,120
Magnets (other than electro-magnets) ...	1,490	2,075	—	105
Land and submarine cables	16,475	90,935	112,005	139,845
Insulated wires	57,860	80,220	126,350	146,950
Copper wire (not insulated)	45,045	39,765	405	2,055
Carbons and electrodes	20,060	24,045	325	470
Porcelain insulators ...	16,575	27,015	3,835	2,700
Electric globes and glassware	29,425	36,400	42,900	31,905
Insulating tubes, junction boxes, &c. ...	14,715	20,925	10,750	7,825
Other insulating material	25,895	20,325	3,135	1,515
Arc lamps	640	710	3,165	860
Incandescent lamps ...	113,765	130,435	26,175	48,630
Wireless valves	75,005	14,985	—	—
Electric measuring instruments	71,470	99,915	5,835	3,815
Telegraph and telephone apparatus ...	195,855	206,460	402,795	321,335
Other electrical apparatus	523,690	832,115	67,020	123,295
Totals ...	£1,596,790	£2,230,945	£942,735	£1,024,615

It will be seen that the imports increased by £634,155, or nearly 40 per cent., the advance being mainly in machinery and unclassified apparatus. On the export side there was an increase of £81,880, or not quite 9 per cent.

The Buenos Aires Exhibition.

Some further particulars relating to the British Empire Trade Exhibition, which is to be held in Buenos Aires next year, appeared recently in the *Monthly Journal* of the British Chamber of Commerce in that city. It was stated that although the original accommodation has been extended by almost 50 per cent., little space remains available for firms who have not yet decided to exhibit. In fact, with the bookings already made, it would be possible to arrange a thoroughly representative exhibition of British industrial production. Heavy machinery will constitute one of the strongest groups in the display and arrangements are being made to exhibit it to the best advantage. The energy for lighting the exhibition will be supplied from a power house which will itself be an exhibit. In the grounds special lighting effects will be arranged, and it is expected that these will prove an enormous attraction. Special attention is being given to banking, cabling, and post office facilities.

The Times reports that in view of the special facilities granted by the Argentine Government for the prompt dispatch of goods specially consigned for display at the Exhibition, the River Plate Conference Lines have agreed to waive the customary surcharge of 5s. a ton on all exhibits shipped to that port. This concession by the shipping companies follows the granting by the Argentine Government of a series of special privileges in respect of Customs duty, licensing, and taxation. In a memorandum on shipping instructions the exhibition authorities point out that arrangements have been made whereby goods for exhibition shipped on the Conference Lines will pay normal freight to Buenos Aires, but goods re-shipped within six months, together with showcases and other accessories forming part of the exhibit, will be carried back to the port of shipment freight free. The memorandum adds that all brands and trade-marks must be registered in Argentina before they become valid in that country. Exhibitors are advised to take steps to register their trade-marks, brands, trade names, &c., at the earliest possible moment in order to protect their trade interests.

A Large Contract for Henley's.

As we reported in our last issue, the Central Electricity Board has placed a contract in connection with the South-East England Electricity Scheme with W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., through Messrs. Merz and McLellan, for the supply and installation of cables for pressures of from 3,000 to 33,000 V, together with auxiliaries, in various towns in South-East England. This follows a contract from the same source, placed with Henley's a few months ago, for the supply and erection in the same area of a large quantity of steel-cored-aluminium conductors on lattice steel towers for 33,000-V pressure.

Electricity in Poultry Farming.

This is the title of one of the latest publications of the British Electrical Development Association (E.D.A. 874). It is a 12-page booklet containing illustrated particulars of the use of electric light to increase egg production; the testing of eggs by electricity; the electrical heating of incubators and brooders, including the conversion of oil-heated types; and the heating of the birds' drinking water in cold weather. In view of the tremendous expansion of the British egg and poultry business during the past few years there seems to be considerable scope for the electrical industry in this direction.

Change of Address.

We are notified of the temporary change of address of the Glasgow Corporation Electricity Department. The new address is 4, West Regent Street, Glasgow. (Telephone: Douglas 5720.)

A Westinghouse Branch in Switzerland.

The Westinghouse Electric and Mfg. Co., of Pittsburgh, U.S.A., is now turning its attention to the Swiss market, a branch office having lately been opened in Bâle under the name of the Alpine Western Electric Co., Succursale de Bâle.

Visit to Metropolitan-Vickers Works.

A visit was paid to the works of the Metropolitan-Vickers Electrical Co., Ltd., on August 30th, by about 40 members of the Doncaster sub-branch of the Association of Mining Electrical Engineers. During the tour round the works great interest was displayed in the latest types of "Metrovick" mining control and switchgear. After lunch the visit concluded with a million-volt display in the high-voltage laboratory.

Proposed Franco-Belgian Electricity Trust.

At the recent meeting of the Société Financière d'Electricité ("Sofina"), of Antwerp, the hope was expressed that it would soon be possible to bring to a close the negotiations for the formation of a Franco-Belgian electrical trust, with headquarters in Paris.

The International Ljungström Turbine Union.

The formation at Basle is announced of the International Ljungström Union with a capital of 1,000,000 Swiss francs. Among the firms interested in the new undertaking, which has obtained licences for the Swedish Ljungström steam turbine for most parts of the world, are Brown, Boveri & Co., the Siemens-Schuckert Works, and the A.E.G. The United States, Canada and France are to be excluded from the scope of the Union; a French group has already acquired the right of using the patents in France. In this country the turbine is manufactured by the Brush Electrical Engineering Co., Ltd.

Bankruptcy Proceedings.

J. M. WALSH, electrical engineer, 33, Villiers Street, Strand, W.C.2.—The first meeting of creditors was held on August 27th at the London Bankruptcy Buildings. The debtor, who petitioned the Court on August 14th, states that his only liability is £72 due in respect of law costs in an action which he launched against a firm for infringement of a patented "combined lighting and advertising device," of which he was the inventor. He lost the action before Mr. Justice Eve, and also in the Court of Appeal, and being unable to pay the costs given to the defendants he filed his petition. In the absence of assets the case was left with the Official Receiver to be wound up in bankruptcy.

F. C. SMITHERS, The Ship Inn, Soham, Cambridgeshire, late 117, Ashdon Road, Saffron Walden, Essex, electrical engineer.—A deficiency of £421, with ranking liabilities of £437, and net assets of £16 were shown in the statement of affairs submitted at the first meeting of creditors held in this matter recently at the Guildhall, Cambridge. The debtor attributed his failure to a decline in the demand for wiring work in Saffron Walden, and lack of capital. The matter was left in the hands of the Official Receiver, as trustee.

W. T. MONK, 9, Rosedale Road, Romford, Essex, electrical engineer.—The receiving order in this matter was made on a creditor's petition on July 16th, and at the first meeting of creditors held recently at 29, Russell Square, W.C.1, a statement of affairs was presented which showed liabilities of £142, and no assets.

O. H. BRADFORD, electrical and wireless engineer, 2a, Hill Street, Griffithstown, Mon.—First meeting held September 4th. Public examination, October 14th, at the Town Hall, Newport.

J. A. MORGAN, radio dealer, Old Queen's Head, Crickhowell, Brecknock.—Receiving order made August 25th on debtor's own petition.

W. H. THORNTON, electrical and wireless engineer, 25, Bridge Street, Burnley.—Application for discharge to be heard on September 18th at the County Court House, Bankhouse Street, Burnley.

D. J. DAVIES, wireless engineer, 36, Cambrian Street, Aberystwyth.—Last day for receiving proofs for dividend, September 12th. Trustee, Mr. H. W. Thomas, 4, Queen Street, Carmarthen.

Company Liquidations.

HARRISON'S, LTD., Oxford Street, Manchester, electrical and wireless engineers.—The statutory meeting of the creditors of the above was held recently at the offices of Messrs. Martin and Stone, C.A., 1, Police Street, St. Ann Street, Manchester. The statement of affairs showed liabilities of £2,131, and net assets of £568. The issued capital of the company was £1,180, and as regarded the shareholders there was a deficiency of £2,743. It was reported that the company was registered in 1920, when it took over an existing business. On December 31st last the accounts disclosed an adverse balance of £1,282, and it was estimated that there had since been a loss on the trading of £847. The deficiency was attributed to those items together with the depreciation written off the assets. A resolution was passed confirming the voluntary liquidation of the company with Mr. W. M. Stone as liquidator. A committee was also appointed. The following are creditors:—

	£		£
Edison Swan Electric Co.	21	H. Hollingdrake	168
Higgs Motors	34	Central Electric Co. ...	40
R. O'Brien & Co. ...	109	British Motor Signs ...	128
Downes & Davies ...	42	L. Watman	524
Hirst, Ibbetson & Taylor, Ltd.	133		

WYNSOR ELECTRIC CO., LTD., Regent Street, W., and Lombard Street, E.C.—Under the compulsory liquidation of this company, Mr. E. T. A. Phillips, Official Receiver, reports that the liabilities are returned at £2,702 against assets of £386 and the deficiency with regard to shareholders is estimated at £3,316 the issued capital being £1,000. The company was formed in May, 1929, to acquire from Louis Burn the business carried on by him as the Windsor Electric Range Co., and to carry on business as manufacturers of and dealers in electrical cookers, radiators &c. The purchase agreement provided that Burn should sell to the company for £1,000 in cash the business and all assets, including Patent No. 279,924, of 1926, relating to the manufacture of electric cookers and should apply and pay for in cash 998 £1 shares. The failure of the company is attributed to insufficient capital and disputes with the suppliers owing to faulty workmanship and delay in delivery of the ranges ordered by the company. Mr. W. H. Stentiford has been appointed liquidator.

MOSSOP'S (LONDON), LTD.—Liquidator, Mr. F. F. Sharles, Salisbury House, London Wall, E.C.2, appointed August 21st. Particulars of claims to the liquidator by September 26th.

PARANA TRAMWAYS CO., LTD.—Liquidators, Messrs. D. W. Jack and F. L. Barry, 2, Rector Street, New York, appointed August 15th.

BORDESLEY ELECTRICAL ACCESSORIES CO., LTD.—Particulars of claims to the liquidators, Messrs. A. Brown and W. Hand, Daimler House, Paradise Street, Birmingham, by September 29th.

ENTERPRISE MANUFACTURING CO., LTD.—Winding up voluntarily. Liquidator, Mr. P. Leask, 27-28, Finsbury Square, E.C.2, appointed August 21st.

Private Arrangements.

J. H. WOOLLISCROFT, electrical engineer, trading as J. H. Woolliscroft & Co., King Edward Street, Liverpool.—At a meeting of creditors on August 27th a representative of the General Electric Co., Ltd., presided, and a statement of affairs was presented showing liabilities of £1,599 and net assets of £1,991, leaving a surplus of £392. The debtor commenced trading about 17 years ago. Proper books of account had been kept, and balance sheets regularly prepared. During the year to March 31st, 1928, there was a loss on the trading of £106, but in the following year there was a net profit of £487. There was, however, a loss during the period to March 31st last of £156. A resolution was passed in favour of a deed of assignment being executed, with Mr. C. M. Dolby and Mr. P. S. Booth, Liverpool, as joint trustees, together with a committee. The principal creditors are:—

	£		£
English Cable Supplies ...	357	A. J. Leigh	54
Pirelli - General Cable Works, Ltd.	105	Johnson & Phillips, Ltd. Liverpool Electric Wire Co.	31 88
Robey & Co., Ltd. ...	114		
General Electric Co., Ltd.	158	Sturtevant Engineering Co., Ltd.	30
Igranic Electric Co., Ltd.	97	A. Hannah	50

Meetings of Creditors.

SPHINX ELECTRIC, LTD.—A meeting of creditors is to be held to-day, September 5th, at the company's offices, Sphinx House, Hatton Garden, E.C.1.

DUDLEY, STOURBRIDGE AND DISTRICT ELECTRIC TRACTION CO., LTD.—A meeting of creditors will be held on September 24th at the Electrical Federation Offices, 88, Kingsway, London, W.C.2, for the purpose of considering the appointment of a liquidator and a committee of inspection.

FOX BROTHERS (SWANSEA), LTD.—A meeting of creditors was to be held on September 2nd at the Hotel Metropole, Swansea.

A North-Eastern "Grid" Contract.

In our last issue we reported that the Central Electricity Board had given, among other contracts, an order for switchgear to Messrs. A. REYROLLE & CO., LTD. Messrs. Reyrolle inform us that the contract is for 66,000-V sub-stations in the North-East England section of the grid, to be erected at Hebburn, Sunderland, and South Shields. Two of the stations are of the "three-switch" type, in accordance with the policy adopted for 132,000-V sub-stations, and the third is a duplicate bus-bar sub-station of seven panels. The three-switch sub-station is an outcome of the single-switch form developed by

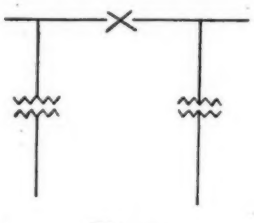


Fig. 1.

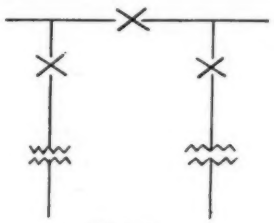


Fig. 2.

the company, the principle of which is that it divides a ring-main by one circuit breaker as shown in fig. 1. For the grid this principle is modified to the extent that additional circuit-breakers are provided in the transformer tee-offs, thus making the sub-stations of the three-switch type as shown in fig. 2. All the sub-stations included in the contract are of the oil-filled metal-clad type originally developed by the company for high-voltage outdoor service, and generally similar to the switchgear that has been in commission at Bradford for over two years, and to the 66,000-V metal-clad switchgear already ordered by the Central Board for the London area.

An Index of Activity.

The B.E.A.M.A. Index of Activity, quoted by the *Board of Trade Journal*, records a figure of 105.2 for July (1924=100) as compared with 103.0 in June and 111.5 in July last year. In spite of this improvement the percentage of insured unemployed workers rose from 7.9 to 8.4 per cent.; the figure for July, 1929, was only 3.8 per cent.

Book Notice.

"Experimental Mechanical Engineering. Vol. I.—Engineering Instruments," by Herman Diederichs and William C. Andrae. Pp. viii+1082; tables and illustrations. London: Chapman & Hall. Price 40s. net.

Disabled Man wants Electrical Work.

A disabled ex-Service man, experienced as a kinema-operator and electrician, has written asking us to appeal to anyone who can do so to give him employment in such a capacity as to enable him to supplement a war pension of 28s. per week for himself and wife. He finds wireless and other firms unwilling to employ a man who has lost a leg though they have much work to do of which such disabled men are capable. We shall be pleased to place any of our readers in touch with our correspondent.

Social Events.

The Sports and Social Club of the County of London Electric Supply Co., Ltd. (Clesco), held its 14th annual horticultural show and garden party on August 30th on its spacious ground at Raynes Park. Glorious weather contributed to the enjoyment of nearly 3,000 members of the club and their friends. In the unavoidable absence owing to indisposition of Sir Harry Renwick, Bart., the chairman and managing director of the company, the prizes were presented to the successful competitors by Mrs. J. E. Guthe, the chairman's daughter. The entries established a new record in number, and it is pleasant to know that all the exhibits were afterwards distributed among the local hospitals. The Lady Renwick Memorial Challenge Cup for the best collection of vegetables was won for the fourth time in succession by Mr. Davie, of the head office. Callender's Premier Band, marionettes, juvenile sports, a treasure hunt, and a cake-making competition were among the other attractions of an enjoyable gathering.

On Saturday last, August 30th, the Macintosh Cable Company's Social and Athletic Club held their first annual sports carnival at Long Lane, Aintree. There was a very large attendance of competitors and spectators in spite of adverse weather conditions. The meeting was admirably arranged, including "all the fun of the fair," and the committee, especially Mr. H. Van Schaick, organising secretary, is to be congratulated on the success of the function. Among those who presented prizes were Mr. T. Martin-Harvey, managing director, Mr. P. Frederick Allan, works manager, and Mrs. Allan, Mr. R. A. Birley, and Mr. J. Mummery. The outstanding event of the afternoon was a fancy dress parade, in which a large number participated, the costumes being judged by Mrs. P. Frederick Allan and Colonel J. Tennant, of B.I. Cables, Ltd. A musical programme was provided by the British Insulated Cable Company's Silver Band, and dancing displays were given by the "Elarco" ladies' dancing troupe under the leadership of Miss H. Hughes. At the close of the proceedings prizes were presented to the successful competitors by Mrs. P. Frederick Allan.

Trade Announcements.

The MARCONIPHONE CO., LTD., is shortly opening a new branch at 13, St. Andrews Street, Dublin. This branch will not only undertake the distribution of Marconiphone products direct instead of through Marconi (Ireland), Ltd., but it will also provide service facilities for Marconiphone dealers in the Free State. Mr. F. Jones will be the company's Free State representative, and will be in charge of the new branch, assisted by Mr. Farmer. The branch will commence its activities in the next week or two.

The address of REGANTS, LTD., is now 53, Great Marlborough Street, W.1. (Telephone: Gerrard 7348; telegrams: Dahlux, Wesdo, London.")

OZONAIR, LTD., has removed to larger offices and works in St. Leonard Street, S.W.1. (Telephone: Victoria 0012; telegrams: "Ozonair, Sowest, London."

In our last issue we reported that Messrs. W. E. BURNAND and Co. had acquired the "Phœnix" electric lifting magnet business from Messrs. Steel, Peech & Tozer, Ltd. Messrs. Burnand now state that the sole selling agency still remains with Messrs. Appleby & Co., 70, Victoria Street, S.W.1.

Messrs. RICHARD JOHNSON, CLAPHAM & MORRIS, LTD., have sent us illustrations of two attractive new display cartons which they have put on the market, one containing a dozen torch cases and the other a dozen flash-lamp cases.

Messrs. F. D. NEWCOMBE & CO., 25, Catherine Street, Exeter, have recently extended their premises and have become factors for electrical goods, in addition to their radio business.

Continental Markets for Domestic Appliances.

A confidential report on the market for domestic electrical appliances in Spain and the Canary Islands has been prepared by the Department of Overseas Trade from information furnished by British Consular officers in Spain, and issued to firms whose names are entered on its Special Register. United Kingdom firms desirous of receiving a copy of this report should communicate with the Department, 35, Old Queen Street, S.W.1. (Reference A.X. 10055.)

The Department has received a similar report upon the French market for these appliances. This, too, can be obtained from the Department. (Reference A.X. 10058.)

Parsons Turbo-alternators for Holland.

According to *The Times*, the London & North-Eastern Railway reports that arrangements have been completed for conveying 1,000 tons of electrical equipment from Newcastle-on-Tyne to Ymuiden, Holland, *via* the Harwich-Zeebrugge train ferry. This equipment consists of two turbo-alternators, complete with condensing plant, which Messrs. C. A. Parsons and Co., Ltd., are manufacturing for the Provincial Electriciteitsbedrjf Van Noord. The machinery will be conveyed in three special trains from Newcastle to Harwich, where the trucks will be shunted on to the train ferry and conveyed to Zeebrugge, whence they will proceed over the Belgian and Dutch railways to their destination, no reloading or transshipment being necessary. The first train, consisting of about 40 wagons, is expected to leave Newcastle about September 21st, and it will be followed by two 24-wagon trains in October and November; these last two trains will be loaded beyond the normal loading gauge and will, therefore, be worked through to Harwich on a Sunday, when the adjacent lines can be kept clear. Two wagons will carry loads weighing 65 tons each, making 104 tons with the weight of the wagon. These are the heaviest single truckloads ever shipped by the Harwich-Zeebrugge train ferry.

Local Exhibition.

BELFAST.—An electrical exhibition is to be held in the Ulster Hall from October 2nd to 9th. It is being organised jointly by the Belfast Corporation Electricity Department, the electrical manufacturers and wholesalers represented in Northern Ireland and the Electrical Contractors' Association. The offices of the Exhibition are at 5, Bedford Street, Belfast, and the chairman of the management committee is Mr. F. R. Unwin, M.I.E.E. The opening ceremony is to be performed by the Rt. Hon. H. Milne Barbour, M.P., D.L.

Proposed Harbour Improvement at Trinidad.

The Trinidad correspondent of *The Times Trade and Engineering Supplement* says that a scheme of harbour improvements at Trinidad, estimated to cost £1,012,000, is at present under consideration, the expenditure having been approved by the local Legislature. If the work goes forward there will be big opportunities for British concerns. The plans include the provision of a generating station, 21 cranes, capstans, &c.

Unemployment.

A decrease of 32,780 was shown in the number of persons on the registers of employment exchanges in Great Britain during the week ended August 18th. At that date the total was 2,017,957, as compared with 2,050,737 on August 11th, and 1,162,284 on August 19th, 1929.

New Catalogues and Lists.

METROPOLITAN-VICKERS ELECTRICAL CO., LTD., Trafford Park, Manchester.—Descriptive leaflet 400/0-1 containing an article by Mr. B. G. Churcher on "The use of the oscillograph in the testing of heavy electrical plant."

L. WILKINSON, 8, City Road, London, E.C.1.—Illustrated lists Nos. 12-15 describing, respectively, small motors, generators and sundries; bedside lamps; wireless apparatus, reflectors, lamps, decoration sets, &c.; and bells, buzzers, pushes, &c.

THOS. VICKERS, LTD., 14, New Street, Birmingham.—A folder illustrating various types of steel barrows for use in electricity works, &c.

THE COVENTRY ELECTRICAL APPLIANCES, LTD., Conduit Works, Conduit Yard, Fleet Street, Coventry.—New season's list of fires, irons, kettles, boiling rings, &c.

S. G. LEACH & CO., LTD., 26-30, Artillery Lane, London, E.1.—An abridged price list, L.F./121, announcing reductions in the prices of the company's entire range of exhaust fans.

THE ENGLISH ELECTRIC CO., LTD., Queen's House, Kingsway, London, W.C.2.—Two well-produced publications entitled, respectively "Electrical Machinery for Radio Transmitting Stations" and "Industrial Locomotives."

The GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2.—The August issue of the "Osram-G.E.C. Bulletin" contains interesting articles on architectural and church lighting, &c.

E. P. ALLAM & CO., LTD., 107-109, Gray's Inn Road, W.C.1.—Current stock lists of d.c. and a.c. electric motors.

HART ACCUMULATOR CO., LTD., Marshgate Lane, Stratford, E.15.—A showcard depicting the use of Hart batteries for house lighting purposes.

SIEMENS BROTHERS & CO., LTD., Woolwich.—Catalogue 160, Section III, dealing with link disconnecting boxes and pillars.

SIEMENS ELECTRIC LAMPS & SUPPLIES, LTD., 38-39, Upper Thames Street, E.C.4.—Illustrated booklets dealing with "Cosyglo" electric fires and "Xcel" domestic electrical appliances.

BROOK MOTORS, LTD., Empress Works, Huddersfield.—A folder on a.c. electric motors.

W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., Holborn Viaduct, London, E.C.1.—Catalogue U.C.D.2, giving details of straight-through branch and service boxes; also a pamphlet entitled "Standardised Boxes for Standardised Cables."

HANS RENOLD, LTD., Burnage Works, Didsbury, Manchester.—Price list (Ref. 016/19) giving particulars of new products, including chain clutches, bush roller chains, chain couplings, tools for inverted tooth chains, chain tensioners, chain cases, rivet extractors, and conveyor chains.

J. A. CRABTREE & CO., LTD., Lincoln Works, Walsall.—Leaflet No. 1057 giving revised prices of "Jacelite" moulded lampholders.

THE INDIA-RUBBER GUTTA-PERCHA & TELEGRAPH WORKS CO., LTD., Silvertown, London, E.16.—A revised edition of a list describing "Silvertown" water-level apparatus.

HIGGS MOTORS, Witton, Birmingham.—Stock list for September.

WHITWORTH ELECTRIC LAMP CO., LTD., 6 and 8, Gorleston Street, West Kensington, London, W.14.—Price list of electric wiring accessories, bells and wireless apparatus.

PHILIPS LAMPS, LTD., 145, Charing Cross Road, London, W.C.2.—A leaflet giving particulars of Philips power amplifiers for use in kinemas, &c.

Calendar blotters for September have been received from Messrs. Mavor & Coulson, Ltd., 47, Broad Street, Glasgow; Pope's Electric Lamp Co., Ltd., Elasta House, 5, Arthur Street, London, W.C.2; and the Jackson Electric Stove Co., Ltd., 143, Sloane Street, London, S.W.1.

Prices of Materials.

The following prices are only general, and they may vary according to quantities and other circumstances:—

	CHEMICALS, &c.	Price Sept. 2nd	Fortnight's inc. or dec.
a	Acid, Oxalic ... ... per lb.	5¾d.	...
a	Ammoniac, Sal ... ... per ton	£60	...
a	Ammonia, Muriate (large crystal) ,,	£52	...
a	Bisulphide of Carbon ... ... ,,	...	...
a	Borax ... ... ,,	£17	...
a	Copper Sulphate ... ... ,,	£25 10s.	...
a	Potash, Chlorate ... . per lb.	3d. to 4d.	...
a	,, Perchlorate ... ... ,,	5½d.	...
a	Shellac ... ... per cwt.	£13 10s.	...
a	Sulphur, Commercial ... ... ,,	£11	...
a	,, Roll ... ... ,,	£11	...
a	Soda, Chlorate ... ... per lb.	3d.	...
a	,, Crystals ... ... per ton.	£5 to £5 5s.	...
a	Sodium Bichromate, casks ... per lb.	3¾d.	...
	METALS, &c.		
b	Aluminium, Ingots ... ... per ton.	£95 to £100	...
b	,, Wire ... ... per lb.	1/1 to 1/9	...
b	,, Sheet ... ... ,,	1/1 to 2/9	...
p	Babbitts Metal and Anti-friction Metals—		
	Grade I ... ... per ton net.	£130	£1 dec.
	Grade II ... ... ,, ,,	£93	£1 dec.
	Grade III ... ... ,, ,,	£56	...
c	Brass (rolled metal 2" to 12" basis) per lb.	8¾d.	...
c	,, Tubes (solid drawn) ... ,,	10¼d. to 10¾d.	...
c	,, Wire, basis ... ... ,,	8¾d.	...
c	Copper Tubes (solid drawn) ... ,,	11¼d.	...
g	,, Bars (best selected) ... per ton	£79	...
g	,, Sheet ... ... ,,	£79	...
g	,, Rod ... ... ,,	£79	...
d	,, (Electrolytic) Bars ... ,,	£62 2s. 6d.	...
d	,, ,, Sheets ... ,,	£143 10s.	...
d	,, ,, Wire Rods ,,	£62 2s. 6d.	...
d	,, ,, H.C. Wire per lb.	8d.	...
f	Ebonite Rod ... ... ,,	2/3 to 2/6	...
f	,, Sheet ... ... ,,	2/3 to 2/6	...
n	German Silver Wire ... ... ,,	2/2	...
h	Gutta-percha, fine ... ... ,,	nom.	...
h	India-rubber, Para fine ... ... ,,	6¼d.	¼d. inc.
i	Iron, Pig (Cleveland No. 3.) ... per ton.	63/4½	16/1½ dec.
l	,, Wire, galv. No. 8. P.O. qual. ,,	£20	...
g	Lead, English pig ... ... ,,	£19 10s.	5s. dec.
g	Mercury ... ... per bot.	£22 10s. to £22 15s.	...
e	Mica (in original cases) small ... per lb.	6d. to 8/-	...
e	,, ,, medium ,,	4/- to 8/-	...
e	,, ,, large ... ,	10/- to 20/- & up	...
p	Phosphor Bronze, plain castings ,,	1/1½d.	...
p	,, ,, drawn bars & rods ,,	1/1d.	¼d. dec.
p	,, ,, rolled strip & sheet ,,	1/1¼d.	¼d. dec.
p	,, ,, wire ... ... ,,	1/1¼d.	...
o	Platinum ... ... per oz.	£7	10s. dec.
d	Silicium Bronze Wire ... ... per lb.	9¾d.	..
r	Steel, Magnet, in bars ... ... ,,	7¾d.	...
g	Tin, Block (English) ... ... per ton	£135 to £136	£1 to £1 10s. dec.
n	,, Wire, Nos. 1 to 16 ... ... per lb.	3/2	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a	G. Boor & Co.	*g*	James & Shakespeare.
b	The British Aluminium Co., Ltd.	*h*	Edward Till & Co.
c	Thos. Bolton & Sons, Ltd.	*i*	Bolling & Lowe.
d	Frederick Smith & Co.	*l*	Richard Johnson & Nephew, Ltd.
e	F. Wiggins & Sons.	*n*	P. Ormiston & Sons.
f	India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.	*o*	Johnson, Matthey & Co., Ltd.
		p	C. Clifford & Son, Ltd.
		r	W. F. Dennis & Co.

In their letter dated August 29th Messrs. James Forster & Co. stated that the lead market continued quiet during last week, most of the business recorded being for August and September shipment. Supplies in sight are well in excess of any probable demand, and it has been apparent for some time past that monthly arrivals have been in excess of the quantity actually consumed. "No doubt the tight control exercised over the market will be continued for the present, but we fail to see how any permanent improvement in values can be looked for under prevailing conditions."

Lighting and Power Notes.

Accrington.—NEW METERS.—The Corporation Electricity Committee is applying for sanction to a loan of £1,307 for new meters.

Ayrshire.—ELECTRICITY SUPPLY AGREEMENT.—Protracted negotiations between the West Kilbride Electric & Lighting Co., Ltd., and the Ayrshire Electricity Board have resulted in an agreement. West Kilbride will now be supplied by the Board who will extend the cables in various parts of the district.

Birmingham.—DEMAND FOR ELECTRIC FANS.—During the recent hot weather the Corporation Electric Supply Department experienced an unprecedented demand for electric fans. On two of the hottest days 900 fans were sent out, of which 700 were sold outright while the others were hired at a weekly rental of 1s. subject to a minimum of 13s. representing a quarter's hire.

Canada.—UNDEVELOPED WATER POWER OF BRITISH COLUMBIA. —According to the *Financial Post* (Toronto), investigations by Provincial engineers have revealed the existence of large undeveloped water power sites along the coast of British Columbia, north of Vancouver. Preliminary reports indicate that in addition to the Taseko-Chilco-Homathko power sites having a possible development of 1,200,000 h.p., two other sources of electricity have been discovered, bringing the possible development of the coast district up to a total of 3,000,000 h.p. These two new sites are at Tahtsa Lake and Eutsuk Lake. By diverting the waters of these lakes westward to the sea, instead of eastward into the Fraser River, engineers believe that 1,800,000 h.p. can be harnessed. The third project calls for the diversion of the Chilco waters westward to the sea by way of the Homathko River.

Cheltenham. — SUB-STATION EQUIPMENT.—The Corporation Electricity Committee has obtained sanction to the borrowing of £2,500 for sub-station equipment.

China.—ELECTRICAL DEVELOPMENT SCHEMES.—The extensive programme of development of the Chekiang Commission of Construction necessitates the generation of a large supply of electrical power, and provision for its distribution throughout the low-lying agricultural districts for drainage and irrigation, and to the important cities for industrial plants. According to the *Far Eastern Review*, the Provincial Government has passed a resolution to re-organise the Dah Yoh Lee Electricity Works, of Hangchow, the control of which has now been vested in the Chekiang Electricity Bureau. A programme of electrical development, covering a period of five years, is now being formulated, involving the construction of a 15,000-kW initial unit for a generating station at Hangchow, the reconstruction of the electrical distribution system in the city of Hangchow, and the construction of transmission lines to Yuhang, Kashing, and Huchow. The construction of irrigation and drainage plants and the addition of the second unit, to the Hangchow plant, of 15,000-kW capacity and an electric railway system for the city of Hangchow are expected to be started during this period. The construction and equipment of an electrical-testing laboratory is also contemplated.

Continental.—GERMANY.—The output of the 122 principal electric power stations in Germany during the five months ended May 31st amounted to 6,956,500,000 kWh, as compared with 6,634,200 000 kWh in the corresponding period last year. It is noteworthy, however, that the increase occurred during the first three months of the year, the output during April and May showing a decline.

FRANCE.—In view of the great industrial development which is taking place on the River Seine between Havre and Rouen, the Société Havraise d'Energie Electrique is planning to extend its area of electricity supply. It proposes to link up its power stations at Havre and Varaville by a 20,000-kVA, 100,000-V transmission line. A second 12,000-15,000-kW turbo-generator set is at present in course of erection at the power station, which by next year will have a total capacity of 63,000 kW. It is also intended to install two additional sets at the Varaville power station, which, when completed, will bring the total capacity of the company's plant to 107,250 kW.

ITALY.—The Italian Government has recently given its approval to a project to the Società Generale Italiana Edison di Elettricità to erect a 130,000-V transmission line between Cerreto Lomellina and Mortara. The Societa Unione Esercizi Elettrici, of Turin, is also erecting a 20,000-V line between Cascina Peitrapa and Giaglione and the municipal authority of Adige-Garda a 40,000-V line between Verona and Schio.

Croydon.—EXTENSIONS.—The Corporation Electricity Committee has approved an expenditure of £2,625 for cable extensions, and £251 for a switch to control the feeder to the Addiscombe Road sub-station.

Halifax.—LOAN SANCTIONED.—The Town Council has received sanction to the borrowing of £100,000 for mains.

Hull.—YEAR'S WORKING.—We have received from Mr. J. N. Waite, city electrical engineer, a copy of his report together with a statement of accounts of the undertaking for the year ended March 31st last. There was an increase in the total revenue from £360,950 to £410,103, the working expenditure being £213,546, as compared with £173,632 in the preceding year; the amount paid by the Department in rates was £24,911, as against £9,132. The gross profit rose from £187,318 to £196,558 and to it was added an unemployment grant making a total of £200,479 available. Loan charges absorbed £131,709, income tax £12,895, and other items £990. There was a net surplus of £54,885, as compared with £68,553 in 1928-29. The capital expenditure during the year amounted to £420,562 and included £280,948 for machinery and £147,270 for mains and services. The total now spent on the undertaking stands at £2,765,842. Sales of electricity increased from 16,105,536 to 18,154,920 kWh and the maximum supply demanded from 29,900 to 32,800 kW. During the year the area of supply was increased by the addition of 118 sq. miles including Beverley, Hedon, Cottingham urban district and parts of the rural districts of Beverley, Skirlaugh, Sculcoates and Patrington. A scheme for the hire and hire-purchase of domestic appliances was introduced and has proved very popular. The assisted wiring scheme is also working very successfully and showed a credit balance of £1,142 for the year under review. Up to the beginning of the year very little use had been made of electricity for street illumination, only 298 public lamps being connected; by March 31st, however, this number had increased to 510, and such good results had been obtained that it is expected that the use of electricity for this purpose will continue to expand. The power supply to the Corporation tramways was taken over at the beginning of March. The extensions to the power station are progressing and are expected to be completed during the current year.

Japan.—NEW POWER STATIONS.—The work on the construction of its 3,000-kW Ichiu hydro-electric station is to be commenced by the Skikoku Hydro-Electric Co. as soon as official sanction is obtained. The Fuji Electric Power Co., No. 2, is also expected to invite tenders shortly for power plant required for its Yuyama power station.

Liverpool.—EXTENSIONS.—The system of supply has now been extended to Hale Heath, Hale, and Halebank, where electricity for lighting purposes is supplied at 4½d. and for power at 2d. per kWh. There is also available a two-part tariff of a quarterly payment of 5 per cent of the annual value of the residence, plus ½d. per kWh consumed. On an initial payment of £2 followed by twenty quarterly payments of 1s. 3d. per lamp, residents may secure the installation forthwith.

Maidstone.—LOAN SANCTIONED.—The Town Council has received sanction to loans amounting to £35,000 for the mains extensions and apparatus.

Manchester.—LOAN.—The Corporation Electricity Committee is applying for sanction to a loan of £60,000 for mains and transformer stations.

Newport.—YEAR'S WORKING.—The accounts of the Corporation electricity undertaking (general manager, Mr. N. J. Young; electrical engineer, Mr. A. Nichols Moore) for the year ended March 31st last record a total revenue of £198,394, as compared with £192,657 in the preceding year and a working expenditure of £102,025, as against £100,622. The gross profit rose from £92,035 to £96,369, to which was added income from other sources making a total of £104,563 available. From this the following sums had to be met: Interest on loans, £44,906; bank interest, £2,753; contribution to sinking and other funds, £43,999; income tax, £6,474; other items, £494. There remained a net surplus of £5,936, as compared with £16,029 in 1928-29. The capital expenditure during the year amounted to £117,793, bringing the total now spent on the undertaking to £1,349,300. The electrical energy sold for all purposes increased from 32,831,179 to 35,174,777 kWh and the maximum supply demanded from 12,975 to 13,700 kW. The average price obtained per kWh fell from 1.297d. to 1.231d. The assisted wiring scheme continues to progress, the total number of installations connected at the end of the year being 5,034, an increase of 1,292 over the previous twelve months. The development of electric cooking also continues, the total number of cooking installations connected increasing during the year by 1,165 to 3,837.

New Zealand.—HUTT VALLEY ANNUAL REPORT.—The report of Mr. E. F. Hollands, engineer and general manager of the Hutt Valley Electric Power Board for 1929-30, states that the total sales of electrical energy amounted to 14,135,301 kWh, as compared with 10,774,189 in the preceding year. The maximum load of the system increased from 3,000 to 4,320 kW, the number of consumers connected rising by 1,274 to 9,521. The total revenue from the sale of electricity was £97,088, as against £74,552 in the preceding year, while the total working expenditure rose from £41,561 to £59,202. Including capital charges the total expenditure was £84,760 (£63,676); there was a net balance of revenue over expenditure of £12,328, as compared with £10,876 in 1928-29.

CHRISTCHURCH.—*Year's Working.*—The report on the working of the Municipal Electricity Department (general manager: Mr. E. Hitchcock) for the twelve months ended March 31st last states that there was an increase in the total sales of electricity from 40,470,596 to 47,564,061 kWh, the maximum load rising from 11,800 to 13,340 kW. The total revenue derived from the electricity supply undertaking amounted to £226,829, as compared with £211,494 in the preceding year. Working expenses increased from £177,914 to

£183,263, leaving a gross profit of £43,566 (£33,580). To this was added a credit balance of £1,318 from the trading account, and £8,979, interest on bank deposits and investments, making a total of £53,863, from which the following items had to be met:—Transfer to municipal general account, £23,475; sinking fund contributions, £11,076; and contribution to special street lighting fund, £571. There was, therefore, a balance of £18,740 which is proposed also to transfer to the municipal general account. The net capital expenditure during the year totalled £28,107, bringing the total now spent on the undertaking to £707,704. The number of consumers increased from 29,426 to 30,693.

Nicaragua.—ELECTRICITY SUPPLY.—According to a recent report there are now ten central electric power stations in Nicaragua. Their combined capacity, however, is only 3,261 kW.

Northern Ireland.—ELECTRICITY SUPPLY SCHEME.—The supplementary report of Mr. J. M. Kennedy, consulting engineer, covering the western area of the province, was issued last Friday by the Northern Ireland Government's Stationery Department. Mr. Kennedy proposes a transmission scheme, linking up the principal centres of population in Londonderry, Tyrone, and Fermanagh with the generating station of the Londonderry Corporation, and also connecting the projected network of the south-eastern area at Dungannon and also possibly the transmission system of the Antrim Electricity Supply Company. For this purpose the western area has been divided into eight districts centring on Londonderry, Strabane, Omagh, Enniskillen, Limavady, Draperstown, Cookstown, and Clogher. It is proposed to connect the various districts by h.p. lines transmitting at 33,000 V, with secondary transmission at 11,000 V feeding the towns and villages. For the purpose of estimating the cost of electricity, it is assumed that the whole supply will be taken from the Londonderry station at cost price, which should vary from about 1.5d. per kWh in 1932 to 1.4d. in 1936-37, being further reduced if the estimates of consumption are realised, to approximately 0.79d. per kWh by the year 1941-42. It is also estimated that with this additional business the demand on the Londonderry station in the year 1936-37 for the new areas and Londonderry together would be approximately twice the requirements of the City of Londonderry alone, and that the saving to the Corporation in this year would be approximately £9,000, increasing to approximately £11,500 by the year of 1941-42. Mr. Kennedy estimates that the average cost of electricity to consumers in these districts in the year 1936-37 would be 3.95d. per kWh, falling by the year 1941-42 to 3.70d. While he agrees that an average charge of, say, 4d. per kWh to the consumer may appear somewhat high, it is pointed out that this is based on the low consumption of 41 kWh per head in each district in the fifth year, and that this figure has already been reached by some undertakings in the County Down area. The capital cost of the scheme is estimated at £1,013,000, but it is recommended that the work should proceed by stages, commencing with the Strabane district, the energy being obtained from the Londonderry station. In the meantime, the other districts are to be explored in detail, with a view to their gradual development in the most promising order.

South Africa.—CAPE TOWN.—Owing to the increased demand for electricity in the city, the electrical engineer states that extensions and additional machinery, costing £100,000 or more, will be necessary within two years. It is expected that about 2,000 new consumers will be connected next year.

Special Orders.—Application is to be made to the Electricity Commissioners for Special Orders authorising (*a*) the Gravesend Corporation to extend its area of supply so as to include the parish of Chalk in the rural district of Strood, (*b*) the Morecambe and Heysham Corporation to extend its area of supply so as to include Middleton and Overton and that part of Heaton-with-Oxcliffe not already included in the supply area; and (*c*) the Electrical Distribution of Yorkshire, Ltd., to supply electricity in part of the urban district of Otley and in the parishes or townships of Askwith, Blubberhouses, Castley, Clifton-with-Norwood, Denton, Esholt, Farnley, Fewston, Great Timble, Leathley, Lindley, Little Timble, Nesfield-with-Langbar, Newall-with-Clifton, Stainburn and Weston in the rural district of Wharfedale.

Stoke-on-Trent.—MAINS EXTENSIONS.—The Corporation Electricity Committee is to apply for sanction to a loan of £20,000 for general mains extensions. Extensions are to be carried out at a cost of £700 to supply 70 houses to be erected by Mr. C. Whalley on the Basford Hall estate.

NEW TRANSFORMER.—An additional transformer is to be installed at the Bedford Road sub-station, Hanley, at an estimated cost of £400.

The Midlands.—INQUIRY.—Subject to the convenience of the interested parties, an inquiry is to be held on September 23rd into the various schemes put forward by electricity undertakers for the electrification of Rutland and parts of Northants and Leicestershire. The schemes under consideration cover almost the whole of Rutland, the rural district of Belvoir and Hallaton, and parts of the rural districts of Barrow-on-Soar, Billesdon, Loughborough, Market Harborough and Melton Mowbray, in the county of Leicester; the rural districts of Barnack, Easton-on-the-Hill and Gretton, and parts of the rural districts of Kettering, Oundle and Oxendon, in the county of Northampton, and part of the rural district of Peterborough.

United States.—HYDRO-ELECTRIC RESOURCES OF THE POTOMAC RIVER.—A report on the potential resources of the Potomac River with respect to power development, navigation, and flood control will be submitted to the War Department soon by the engineer officer in charge of the Washington, D.C., district. This report is part of the general survey of the nation's water resources authorised during a previous session of Congress. *Power* states that while the details of the report are not available, it has been established that the Potomac is one of the most promising streams in the South Atlantic section for power development purposes. Although the river does not possess as much potential power as some of the other streams in the Middle Atlantic section, its ease of control makes it adaptable to an interconnected system.

Wakefield.—LOAN SANCTIONED.—The Corporation Electricity Committee has obtained sanction to the borrowing of £8,332 in connection with the coupling up of the Wakefield power station to the overhead lines of the Central Electricity Board.

York.—LOANS SANCTIONED.—The Corporation Electricity Committee has obtained sanction to the following loans:—Sub-station buildings, £1,000; mains, £26,948; and sub-station equipment, £4,310.

Tramway and Railway Notes.

Argentina.—BUENOS AIRES.—According to the *Financial News*, the first section—4½ miles—of the new £4,000,000 underground railway in Buenos Aires is approaching completion, and will be opened for traffic in the early autumn. The line, which will be 5½ miles long in all, will run from the terminal station of the Buenos Aires Central Railway to the port at Callao, the entire distance being covered in twenty minutes, in comparison with fifty minutes under present conditions. It is estimated that 200,000 passengers a day will be carried by the new tube, bringing an estimated revenue of £300,000 a year to the Buenos Aires Central Railroad and Terminal Co., by whom it is being constructed. Cars for the railway have been constructed by the Metropolitan-Cammell Carriage, Wagon and Finance Co., and delivery of the entire 56 cars is expected to be completed this month.

Chile.—MORE ELECTRIC LOCOMOTIVES REQUIRED.—The Chilean Government, as largest holder in the Chilean Transandine Railway, now unified with the Argentine Transandine Railway, notifies its intention of further developing the railway system. The line, 70.5 km. long, which starts at 834 m. above sea-level and rises to 3,207 m., has become very profitable, and the Administration has decided to place orders with a Swiss firm for several more 85-ton electric locomotives with rack attachment. The Chilean State Railway has placed an order, valued at £100,000, with the Westinghouse Electric International Company for four extra passenger locomotives, raising the number of all types in service to 43. The new type of electric locomotive will weigh 130 tons, and will operate at 3,000 volts, with a speed of 63 m.p.h.—*Reuter's Trade Service* (Santiago).

Halifax.—NEW TRAMCARS.—The Town Council proposes to spend £20,000 on new tramcars.

India.—BOMBAY.—The Government of Bombay has written to the Corporation asking for its views on a letter from the general manager of the Bombay Electric Supply and Tramways Co., Ltd., regarding a scheme suggested by the company for the construction and operation of railless cars.

Japan.—RAILWAY ELECTRIFICATION.—The Iyo Railway Co. has decided to electrify the Matsuyama-Takahama section of its system.

Lanarkshire.—TRAMWAY ABANDONMENT.—The Lanarkshire Tramway Co. proposes to substitute 'buses for trams on the Newmains-Cambuslang route on September 30th.

Newport (Mon.).—YEAR'S WORKING.—The report on the working of the Corporation tramway undertaking (general manager, Mr. N. J. Young; tramway engineer, Mr. A. Nichols Moore) for the twelve months ended March 31st last shows that there was a total revenue of £90,246, as compared with £89,332 in the preceding year. Working expenses declined from £67,180 to £65,865, the gross profit being £24,381 (£22,152). To the gross profit was added income from other sources making a total of £35,858 available. After providing for capital and other charges there was a net surplus of £4,216, as compared with a net deficiency of £1,583 in the previous year. The number of passengers carried increased from 14,036,395 to 14,147,734, but the car-mileage fell from 1,233,856 to 1,220,966. The receipts per car-mile were 17.74d., as against 17.37d. in 1928-29.

Telegraph and Telephone Notes.

Brazil.—INTERNATIONAL COMMUNICATIONS.—The Companhia Radio Internacional de Brazil, an associated company of the International Telephone and Telegraph Corporation, has been granted a concession to construct radio stations and carry on international radio-telegraph and radio-telephone services from Brazil. Stations will be installed to give telephone service to the United States and Europe, as well as other countries connected to the extensive International system network of South America. The radio-telegraph service will be established to all parts of the United States *via* the Mackay radio station at Sayville, and with Brazil, Argentina, Columbia, and Peru through the radio stations attached to the International system. The concession is for a period of ten years and is renewable.

China.—CABLE CONFERENCE AT NANKING.—A statement from a Chinese source says that, with regard to the conference meeting at Nanking between representatives of the Ministry of Communications and representatives of the Great Northern, Eastern Extension and Commercial Pacific Companies, it is understood that the foreign companies have agreed to the general principles laid down by the Ministry including the cancellation of the exclusive privilege of landing cable lines, as well as to the supervision and regulation by the Government of the transmission and reception of messages. Subsequently the conference discussed the increase of telegraph rates and cable rates for which the Government is pressing.—*Reuter* (Nanking).

Curacao.—NEW TELEGRAPH FACILITIES.—More telegraph facilities will become available shortly through a new cable about 240 nautical miles long, to be laid from Willemstad, capital of the Dutch West-Indian island of Curacao, to Maracaibo, Venezuela. It is expected that the cable will be in operation by October. It is also proposed to lay a new line from Maracaibo to Barranquilla (Colombia). The new cable will afford direct submarine communication with the rest of the world.—*Reuter's Trade Service* (Caracas).

Fleetwood.—WIRELESS TELEPHONES FOR TRAWLERS.—Two steam-trawlers belonging to the Iago Steam Trawler Co., Ltd., have recently been fitted with wireless-telephone sets at Fleetwood. The telephones have a day radius of 250 miles, and a radius at night of about 500 miles.

India.—PROPOSED RADIO-TELEPHONE SERVICE WITH GREAT BRITAIN.—In view of the fact that certain proposals are before the Government regarding the establishment of a wireless telephone service between Bombay and Great Britain, the director-general of Posts and Telegraphs, India, recently consulted the Bengal Chamber of Commerce with regard to the need for and utility of such a service. The Chamber of Commerce expressed the opinion that the service would meet with considerable success provided that clear and good results could be obtained.

Irish Free State.—SHIP-SHORE TELEPHONY.—A telephone service with the liners *Majestic*, *Olympic*, *Homeric*, and *Leviathan* was made available to Dublin subscribers on August 31st. The normal charge is £1 12s. a minute (with a minimum of £4 16s. covering three minutes); and the "report charge" payable instead of the normal charge, when the person wanted by the caller cannot be found and connected, will be 12s. The hours of service with these ships vary somewhat with their position, the service continuing each day for about 10 hours within the period 10 a.m. to 10 p.m. Calls which cannot be completed within these hours can be held over from day to day without extra charge until the conclusion of the trans-Atlantic voyage. The service will be extended to other ships as opportunity offers.

South Africa.—PORT ELIZABETH.—At Port Elizabeth, which was the first city in South Africa to be equipped with the automatic telephone, subscribers are still being added at the rate of twenty per month. Since 1926 3,782 new connections have been made. To relieve congestion at the central post office it has been decided to establish branch exchanges at Cape Road and Walmer.

Transatlantic Communications.—MONTHLY CONTRACT CALLS.—The Postmaster-General has announced that, as from last Monday, September 1st, "subscription" calls will be obtainable in the trans-Atlantic telephone service at any time between 11 p.m. and 12 noon, British time (6 p.m. to 7 a.m. New York time). These calls are arranged for connection at a fixed time daily on a monthly contract basis at half the normal rate of charge. The conditions governing "subscription" calls in the Anglo-Continental telephone services will apply generally to trans-Atlantic "subscription" calls. In the latter case, however, the daily contract period must be five minutes or a multiple thereof.

PROPOSED NEW CABLE.—For some time a new transatlantic cable between the British Isles and America has been discussed, and the *Financial Times* states that the American Telephone and Telegraph Company and the Felten and Guilleaume concern are interested in the scheme. Successful experiments are understood to have been made in the Bay of Biscay, and it is reported that negotiations are proceeding favourably for the development of the plan.

Radio Notes.

Communal Reception.—DUNDEE.—The Town Council has refused an application for permission to install a radio relay service in the city. The erection of private lines across the street was the principal cause of objection.

Irish Free State.—"SPONSORED" PROGRAMMES.—The *Wireless World* states that the broadcasting authorities of the Irish Free State have decided to test the value, financial and otherwise, of programmes sponsored by advertisers during a trial month beginning on October 20th. The advertisers' programmes will go out from Dublin and Cork, and will be limited to one hour each evening.

Italy.—ELIMINATION OF ATMOSPHERICS.—The E.I.A.R. (Italian Broadcasting Company) has been experimenting with an invention, the work of a young Genoese, Signor Bruni, for the elimination of atmospheric and electrical disturbances affecting wireless transmissions, and has placed a transmitting station at his disposal for further experiments. *World Radio* states that representatives of the Navy and Army, as well as of the E.I.A.R., have been present at trials, and have expressed their satisfaction at the results achieved. The inventor, Signor Bruni, is only twenty-one years of age.

Poland.—NEW STATION.—The new LVOV 16-kW broadcasting station is nearing completion and will commence experimental transmission about the middle of October.

Power Rating of Transmitters.—THE B.B.C.'s DECISION.—At the request of the International Broadcasting Union, the B.B.C., in common with other broadcasting organisations, has adopted a new power rating for its transmitters. The actual power of all B.B.C. stations is the same as before, though the method of computing the power rating has been changed to comply with the new international definition. Thus, while the actual power transmitted from the National station at Brookmans Park remains unaltered, its power rating has been changed from 30 kW to 45 kW. In the past different broadcasting organisations have used different methods of measuring the power of their transmitters and the introduction of a common system of power rating will remove the confusion that has existed. The new system of computing the power of a broadcasting station takes account of modulation, which the method formerly used in this country did not.

United States.—HIGH-POWER BROADCASTING.—*World-Radio* states that engineers in the United States have been testing with 200 kW of aerial power for broadcasting. The transmitter is situated at a radio laboratory a few miles south of Schenectady, where facilities are available for the power requirements of a large number of transmitters. There are four steel aerial towers, three 300-ft. high, and one 150-ft. high, and, in addition, a large number of small masts, between all of which are many different types of aerials. At the main power house are rectifiers capable of supplying 750 kW of d.c. at 20,000 volts. In the 200-kW transmitter there are six 100-kW power valves. Each is 5 ft. long, or 7½ ft. including the water jacket.

A Portable Electro-cardiograph.

A light-weight instrument for recording on photographic film the electric currents that accompany heart action, and operating from dry batteries contained within the case, has recently been developed by the Westinghouse Electric Co.

The minute currents generated by the heart and flowing through the body are transmitted to the instrument through electrodes attached to the two arms and the left leg. The heart current is then amplified by tubes similar to those used in radio receivers. The amplified current causes the vibration of a tiny mirror in the galvanometer upon which is directed a beam of light, which causes impulses that are caught and recorded by a spring motor-driven camera arranged to receive standard 100-foot rolls of moving-picture film.

Although the spring motor has a governor to hold the speed within 1 per cent., some parts of the record may not always be within the limit. To overcome this difficulty, a time-marker, which operates independently of the motor, is installed to make lines one-twenty-fifth of a second apart on the film; this enables the operator to discard unsuitable portions.

The combined efforts of galvanometer and amplifier have been calculated with a view to preventing distortion of the impulses. These calculations are based on 1 in. per second film speed with 1 cm. deflection per millivolt, and the characteristics of the recording apparatus. It is claimed that the wave is correct for phase relations up to the 75th harmonic.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the Electrical Review containing the advertisement is given in parentheses below.

Contracts Open.

Ashbourne.—September 20th. Urban District Council. Transformer kiosk and equipment; also e.h.p. and l.p. cables and roadwork. (August 22nd.)

Australia.—Melbourne.—Posts and Telegraphs Department. September 30th. Switchboard, instruments, and test plugs and sleeves. (A.X. 9937.)*
Transmitters and associated parts. (A.X. 10077.)*
October 14th. Condensers. (A.X. 10000.)*
Sydney.—September 15th. Municipal Council. H.p. pilot cables. (A.X. 10079.)*
September 29th. 33,000-V cable. (A.X. 10078.)*

Birmingham.—September 22nd. Salvage Department. Steam-driven generators and balancer set. Specifications from the general manager, 161, Corporation Street (deposit £1 1s.).

Bromley Cross (near Bolton).—September 15th. Ring mains, switchgear and transformer. Specifications from the clerk, Council Offices.

Cardiff.—September 8th. Electricity Department. Electric locomotive. (August 22nd.)
September 16th. Corporation. Electric pumping plant. Specifications, &c., from the city engineer, City Hall.

Egypt.—Zagazig.—October 15th. Municipal Council. Four 25-kVA single-phase transformers. (A.X. 10,153.)*

Irish Free State.—Dublin.—September 10th. Port and Docks Board. Electric portal wharf jib cranes. Particulars from the engineer's office, East Wall.

London.—London County Council.—September 15th. Wiring and fittings at the Whitechapel Fire Station. (August 22nd.)
Central Electricity Board.—October 6th. 66,000-V and 33,000-V overhead transmission lines for the North-East England Electricity Scheme. (August 29th.)
October 20th. Metering equipment for certain stations in connection with the Mid-East England Electricity Scheme. (See this issue.)
Office of Works.—September 9th. Electric bells, buzzers, bell pushes, &c. (August 29th.)
September 15th. Steel (conduits) tubes and fittings. (See this issue.)
September 23rd. New electric lift at Somerset House, W.C.2. (See this issue.)

Marlborough.—September 25th. Electricity Department. Extension of 11-kV, 3-phase overhead lines to Savernake Hospital. (August 22nd.)

Newcastle-upon-Tyne.—October 10th. Newcastle-upon-Tyne Electric Supply Co., Ltd. Steel frame buildings for power station; also 120-ton and 25-ton overhead electric travelling cranes. (August 29th.)

New Zealand.—Wellington.—Post and Telegraph Department. September 10th. Dry cells. (A.X. 10093.)*
September 18th. Ebonite earpieces. (A.X. 10096.)*
November 5th. Telephone transformers. (A.X. 10170.)*

North Berwick.—September 16th. East Lothian County Council. Electrical work at High School extension. Form of tender from R. & A. K. Smith, 4, Forres Street, Edinburgh.

Oldham.—September 19th. Public Assistance Committee. Electric lamps and fittings. Tenders to J. J. Williams, town clerk.

Sittingbourne.—September 11th. Urban District Council. Electric lighting installation, Town Hall.

South Africa.—Johannesburg.—September 20th. City Council. H.p. and l.p. insulators and shackles. (A.X. 10124.)*
H.p. and l.p. cables. (A.X. 10125.)*
Oil switches. (A.X. 10126.)*
Cape Town.—October 1st. City Electricity Department. Four-pin plugs and sockets. (A.X. 10,166.)* Metal-clad combined switch- and fuseboards. (A.X. 10,167.)*
October 16th. Electric cables. (A.X. 10,162.)*

Staffordshire.—September 27th. Education Committee. Installation of electric lighting at new Rookery Lane senior mixed school, Pensnett, near Dudley. (August 29th.)

Turkey.—Ankara. (Angora).—September 16th. Posts, Telegraphs, and Telephones Department. Telegraph wire. (A.X. 10075.)*

Wrexham.—Electricity Committee. Wiring of 173 houses, Holt Road site. (August 29th.)

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.

Contracts Closed.

Birkenhead.—Electricity Committee. Accepted:—
Switchgear (£376).—New Switchgear Construction Co., Ltd.

Manchester.—Waterworks Committee. Accepted:—
Cables for lighting village at Burn Banks.—Macintosh Cable Co., Ltd.
Electricity meters for Haweswater.—Ferranti, Ltd.
Education Committee. Accepted:—
Alterations to electrical installation at Johnson Street school, Ashton Old Road school, and Lily Lane school.—A. Loudon.
Wiring for electric cookers: Holland Street and Queen Street schools.—R. Seddon & Sons; Thomas Street school.—Brookes, Ltd.

Salford.—Corporation. Accepted:—
Switchgear extension.—Erskine, Heap & Co.

Sheffield.—Health Committee. Accepted:—
Automatic fire alarm system at workshops for the blind (£167).—Associated Fire Alarms, Ltd.
Electricity Committee. Accepted:—
Six transformers (£627).—Ferranti, Ltd.
Tramways Committee. Accepted:—
500 steel tram tires.—J. Brown & Co., Ltd.

Stirling.—Town Council. Accepted:—
Installation of electric light in connection with the Burnside Street housing scheme.—Graham & Morton.

West Mersea.—Urban District Council. Accepted:—
Electric motor and pumps for sewage disposal works (£156).—Truslove & Co., Ltd.

York.—Electricity Committee. Recommended:—
Switchgear and transformers for Silver Street sub-station (£2,869).—English Electric Co., Ltd.
Electricity Committee. Recommended:—
Ash conveyor for Agecroft power station (£1,223).—John Thompson Water Tube Boilers, Ltd.
Feeder between Frederick Road electricity station and Trafford sub-station (£4,676).—W. T. Glover & Co., Ltd.

Forthcoming Events.

British Association.—Bristol. September 3rd to 10th. Annual meeting.

Union Internationale des Producteurs et Distributeurs d'Energie Electrique.—Brussels. September 4th to 14th. Third biennial congress.

Association of Public Lighting Engineers.—Leicester. September 8th to 11th. Annual meeting and conference.

Institute of Metals.—Southampton. September 9th to 12th. Autumn meeting.

Iron and Steel Institute.—Prague, Czecho-Slovakia. September 15th to 20th. Autumn meeting.

Second British Glass Convention.—Buxton. September 17th to 20th.

Women's Engineering Society.—Oxford. September 19th to 21st. Eighth annual conference.

National Radio Exhibition.—Olympia. September 19th to 27th.

Municipal Tramways and Transport Association (Inc.).—Harrogate. September 24th to 26th. Annual conference.

British Science Guild.—Liverpool. October 22nd. Lecture by Lt.-Col. Sir David Prain on "Science Discipline." London. November 13th. Annual Norman Lockyer lecture by Prof. Sir William Pope.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

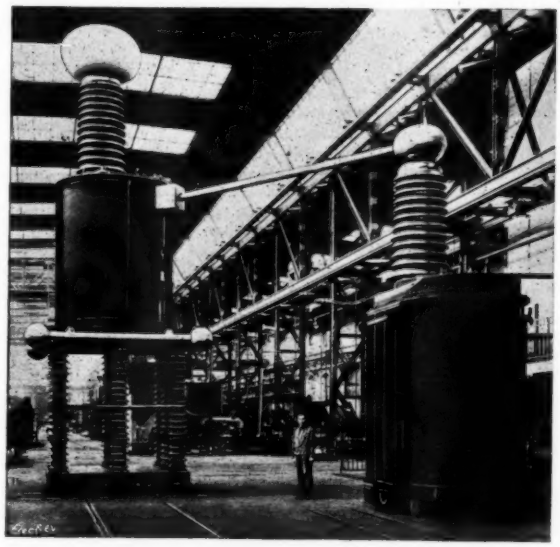
We shall be glad to learn the names and addresses of makers of the following devices:—

GUEST bakelite lampholders.
Poultry dressing machines.

Notes.

One-million-volt Testing Plant for Russia.

The accompanying illustration depicts the one-million-volt testing plant which has recently been completed at the transformer works of the Siemens-Schuckertwerke Gesellschaft at Nuremburg, Germany, for the All-Russian experimental



The Moscow Million-volt Testing Plant.

electro-technical institute in Moscow. The plant comprises two 500-kV transformers connected in cascade form to give one million volts to earth, the combined capacity being 1,000 kVA. The installation has been arranged so that at a later date a similar set can be added to permit of tests up to two million volts. The transformers are fed with power by a 5,000-kVA generator set.

The Electric Furnace.

In a paper issued in the August bulletin of the Société Française des Electriciens, Monsieur Albert Levasseur describes recent progress in the employment of the electric furnace for steel manufacture. Steel is usually obtained, he observes, by the decarburisation of iron, and therefore the first aim of the electro-metallurgist is to make electric steel by a similar process. In this respect he appears to be wrong, for in the majority of cases electric steel is manufactured, not from iron, but from steel itself. In France the price of pig iron is from 450 to 650 fr. per ton, whereas steel turnings and other forms of steel scrap may be obtained at 200 fr. per ton, and often at a much lower price. The fusion of this scrap in the electric furnace has two objects which are frequently pursued simultaneously: (*a*) the transformation of poor-quality metal into a superior quality, and (*b*) the moulding of castings direct. The electric furnace is also employed very usefully in receiving liquid iron from the blast furnace, or mixer, and transforming it into steel, or in receiving steel from a convertor or Martin furnace for more complete refining. The last process is generally to be preferred, for the electric furnace is not well adapted to decarburisation, whereas it is admirably suited for deoxidation and desulphurisation—in which work the consumption of current is reduced to a minimum—and for the manufacture of special steels. The Martin furnace usually delivers the steel much too cold for the pouring of special and small castings; it affords no flexibility in manipulation; and turns out important quantities of steel which have to be used immediately. The electric furnace overcomes all these difficulties. From an economic point of view the electric furnace produces steel of exceptional purity in spite of the cheap and impure nature of its raw material. It is almost impossible to charge the Martin furnace with turnings on account of their bulk, while even with large and heavy scrap the losses in fusion are much higher with the Martin than with the electric furnace. The consumption of electricity is not so heavy as is sometimes imagined, for molten steel may be refined in the electric furnace at the cost of 130 kWh per ton, and cold steel with 500 to 900 kWh. The electric furnace works very advantageously in both these processes.

The author then describes important progress made recently with certain types of electric furnaces, arc furnaces and automatic regulation, rotating arcs, electrodes, economisers, and methods of tipping. Finally, he emphasises the necessity for the electrician to study the requirements of the metallurgist, as the success of electrical methods depends almost entirely on the extent to which these requirements are satisfactorily met.

Educational.

REGENT STREET POLYTECHNIC, London, W.1.—Courses in electrical engineering, electrical technology, telephony and telegraph, wireless and high-frequency engineering will commence on September 22nd; enrolment will take place from September 15th to 19th. The electrical laboratories are also available for work of a post-graduate and research character. Prospectuses from the Director of Education.

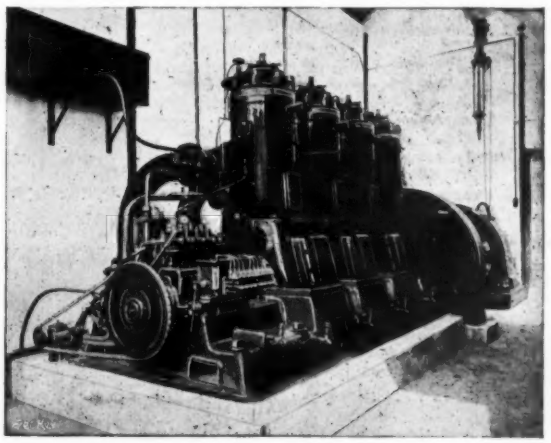
NORTHAMPTON POLYTECHNIC INSTITUTE, St. John Street, London, E.C.1.—Enrolment begins on September 15th for courses in fuel technology for combustion and power station engineers. The new session commences on September 22nd. Particulars may be obtained on application to the Principal. Evening classes begin on September 22nd. Enrolment during week commencing September 15th.

L.C.C. SCHOOL OF ENGINEERING & NAVIGATION, High Street, Poplar, E.14.—Particulars are now available from the Secretary of courses in electrical engineering and electrical installation work which commence on September 22nd. Enrolment will take place during the week commencing September 15th.

BATTERSEA POLYTECHNIC, London, S.W.11.—Day and evening classes in electrical, mechanical, automobile, and civil engineering will re-open on September 22nd. Entrance examination to Day College commences September 16th; enrolments for evening classes will take place from September 18th. Particulars of all classes on application to the Principal.

Diesel Set in Glove Factory.

The accompanying illustration shows the generating plant recently installed at the glove factory of Messrs. W. J. and E. G. Ricketts, for supplying the necessary electricity for the motive power in the factory. The set comprises a four-cylinder 160-b.h.p. "Petter" atomic Diesel cold-starting airless-injection heavy-oil engine directly coupled to a G.E.C. generator. The output is 100 kW at 480 volts, 330 r.p.m., the cyclic irregularity being limited to 1/250. The plant is self-



100-kW Atomic Diesel Generating Set.

contained and occupies small floor space. A small independent air-compressor unit, consisting of a 1½-h.p. "Petter" universal engine directly coupled to a suitable air compressor, supplies the starting charge of air to large storage receivers.

Appointments Vacant.

An inspector of X-ray and other apparatus in hospitals, &c., for the London County Council.

Teachers in generation and utilisation of electrical energy for Erith Technical College.

Electrical foreman for the Sudan Government Railways.

(See our advertisement pages to-day.)

High-powered Electric Locomotives.

The four 1,500-V, 5,400-h.p. (one-hour rating) express locomotives recently supplied by the Oerlikon Co. to the P.L.M. Railway for use on the Mount Cenis line are said to be the largest single locomotives ever built.

The Midi Railway obtained the loan of one of these locomotives for the purpose of trial runs at a speed of 75 m.p.h. on the Bordeaux—Bayonne section (122.7 miles) which is equipped with overhead contact wire. This line has frequent gradients and inclines, with values up to a maximum of 1 in 182 and long straight stretches up to about 30 miles in length.

The locomotive was run light over a 67-mile section at speeds up to 75 m.p.h. and, on the return journey it was used for hauling an express train of about 200 tons. During that run, the commercial speed attained was 59.6 m.p.h., without the use of the parallel connection of motors. On the following day, a train with a trailing weight of 600 tons, and consisting of 16 four-axle coaches was hauled, and the following readings were taken on the locomotive instruments:

Connection.	Amps.	Volts.	H.p. at wheel rim.	Speed m.p.h.
Parallel	2,000	1,320	3,270	57
Parallel with 45% field reduction of 30%	1,920	1,300	3,030	66
... 45%	1,720	1,320	2,760	69
	1,920	1,250	2,900	71

The locomotive was transferred to the regular service for hauling the fastest express trains with trailing weights up to about 435 tons. During these runs speeds of 62 m.p.h. were attained over a 91.6-mile section. Work on the permanent way and signals caused some long stoppages, and in order to make up for lost time a speed of 75 m.p.h. had to be maintained over nearly the whole section, 122.7 miles in length. The following readings were taken:—

Connection.	Amps.	Volts.	H.p. at wheel rim.	Speed m.p.h.
Parallel-series with field reduction of 45%	1,440	1,450	2,530	71
Ditto 45%	900	1,600	1,740	63
Parallel-series with full field	1,170	1,500	2,130	73
Ditto	1,080	1,490	1,950	74

It was not necessary to resort to the parallel connection of motors for obtaining the specified speed with the load in question. As heavier loads were not provided for, in the case of ordinary express trains, special trains were formed with a trailing weight of 600 and 800 tons, and it was possible to reach speeds up to 75 m.p.h. even with these heavy trains. It was seldom necessary to use the last reduced field step. A single pantograph was used for collecting current at all speeds up to about 1,800 amps., two collectors being utilised only above that value. In all cases starting up took place without the slightest difficulty.

The performance with an 800-ton train was similar to that for the 600-ton train. The corresponding electrical data are as follows:—

Connection.	Amps.	Volts.	H.p. at wheel rim.	Speed m.p.h.
Parallel-series 30%	1,800	1,600	3,520	49
with field re- 45%	2,000	1,390	3,370	64
ductions of .. 45%	2,000	1,300	3,170	69
Parallel-series with full field	660	1,475	1,080	74
Parallel-series with field reduction of 45%	2,320	1,430	4,050	70
Parallel-series with full field	2,360	1,450	4,550	53
Parallel-series with field reduction of 30%	2,520	1,350	4,150	62

The maximum output of locomotive at wheel rim was 4,550 h.p. in the case of parallel-series connection of motors, at 1,450 volts and 53 m.p.h. Speeds of 75 m.p.h. were reached several times and maintained even over long stretches.

As the sub-stations were not in a position to supply enough energy, the full output of the locomotive, *i.e.*, 5,400 h.p. at 1,500 volts, could not be reached at these tests.

Speed-control of Power Station Auxiliaries.

What is claimed as a new system of speed control for motors has, according to *Power*, been introduced in the design of the auxiliary drives at the power stations at State Line, near Chicago, and Powerton, Illinois. The principal feature is that a squirrel-cage a.c. motor provides the base speed and a d.c. motor is used for speed variation. Two 2-machine units are used, a drive unit and a regulating unit. The drive comprises a constant-speed alternating-current motor of either the induction or the synchronous type, and an adjustable-speed direct-current motor. The alternating-current motor differs mechanically from standard types in that both the rotor and the frame, which is usually called the stator, are free to rotate about their common axis. The rotor is connected to the load, and the frame to the direct-current motor. The frame may be rotated by the direct-current motor or the operation may be reversed. Current is delivered to the alternating-current motor windings through collector rings. The direct-current motor is a standard shunt-wound type with separately excited field.

The regulating unit is a standard motor-generator set. Voltage of its direct-current machine is adjustable between zero and maximum, in either a positive or a negative direction. The direct-current regulating machine sometimes acts as a generator and sometimes as a motor, depending on whether the main induction motor is operating above or below synchronous speed.

When its frame is at rest the alternating-current drive motor acts as standard machine running at rated speed. If a higher load speed is desired the direct-current voltage is built up by increasing the excitation of the direct-current regulating machine, which then delivers energy to the direct-current drive machine. The latter then acts as a motor to drive the alternating-current motor's frame in the same direction as the rotor. With constant field excitation the direct-current drive machine tends to rotate at a speed in direct proportion to the voltage impressed on its terminals. The speed of the frame, and, hence, the increase in speed of the load, are thus built up in the same proportion.

If a lower load speed is desired, the voltage of the direct-current regulating machine is built up in the opposite direction. As a result, the alternating-current motor's frame drives its direct-current machine in a direction opposite to that of the rotor and causes it to deliver energy to the direct-current regulating machine, which, in turn, acts as a motor to drive its alternating-current motor as a generator. The latter then delivers energy to the alternating-current supply system. Decrease in speed of the load is at the same rate as the change in direct-current voltage.

Mechanical connection between the two machines of the drive unit may be one of several different forms. The direct-current machine may be direct connected to the rotating frame; it may be connected through multiple V-belts; or it may be belt, gear, or chain driven.

Another form of drive unit, somewhat different from that just described, employs a differential or planetary gear in place of the rotating stator. Here a standard alternating-current motor is connected to the internal gear, a standard direct-current motor is connected to the sun gear, and the load is connected to the cage that carries the planet gears. The method of speed control is the same as that used with the rotating-frame arrangement.

A Transmission-line Surge Indicator.

Flash-overs on transmission lines—with a discharge of energy over the string of insulators to the metal tower and to ground—may result from a direct lightning stroke, from high voltages induced in the line by lightning discharges at a distance, or from other causes. The flash-over may be harmless and not affect the insulators, or it may crack one or more or otherwise injure them. In the past it has been necessary for the line patrol to inspect the insulators regularly with a telescope or field glass, but not all damaged units can be seen from the ground, and some that seem damaged are simply streaked by rain or dirt. An instrument developed in the United States—the surge indicator—gives the patrol a definite check on the insulators which have been subjected to a flash-over, so that an accurate inspection for damage can be made. For a number of years the need has been felt for an inexpensive device which could be connected conveniently to a circuit without danger to circuit operation, and which would give visible indication when a surge voltage occurred. The surge indicator, fulfilling these requirements, consists of a small releasing link and an indicating target mounted in a nine-inch case. The disrupting link operates on a very small amount of energy, such as is obtained when the device is connected in parallel with a section of the iron on a transmission line tower, and surges of short-time duration (such as lightning surges) will be detected. The releasing link disrupts when the surge occurs, and a spring pressure quickly turns the indicating disk to the "visible" position. The instrument is reset by turning the indicating disk to the "invisible" position and inserting a new link. When installed on a tower, the instrument is clamped to the metal structure, usually on the tower arm and near the tower so that the link can be replaced conveniently. The location of the indicator depends on the details of the tower and the insulator-assembly design.

Fatality.

Methods used by electricians in wiring lighting systems were reviewed at a Nelson inquest on August 29th, when the Coroner made strong comments regarding the dangers of running wires near gas pipes. The inquest was on William Sharples (68), Wellington Street, Nelson, who died as the result of inhaling gas which escaped in his bedroom. The jury expressed the opinion that the inspection of electric installation left much to be desired, and suggested a more thorough inspection, particularly of work which would later be concealed, and, further, that principal installations should only be done by persons duly registered. Mr. H. Roberts, gas distribution superintendent to the Corporation, said he found electrical wiring wrapped round a gas pipe, and a small hole had been made in the lead through the electrical wiring fusing. Arthur Hennings, of Nelson, said two years ago he was engaged by his brother to install electric wiring at this house. The in-

stallation was tested by the Corporation. His brother was a master electrician at Burnley, and houses were wired in the area similar to this one. They were allowed to cut gas pipes. He denied that he had wrapped the wiring round the gas pipe. James Jennings, master electrician, Burnley, said he assisted in wiring this house. He was recognised by Burnley Corporation as a tradesman electrician. His jobs were tested and passed as correct. The Corporation solicitor said they were taking steps at Nelson to have registered electricians, and that register was about to be an accomplished fact. The Corporation was undertaking the wiring of houses in a proper way, and was thereby safeguarding the interests of consumers.

Power Plant Development.

In the general report on Section 7, Construction and Operation of Large Power Plants, of the Second World Power Conference, held in Berlin in June last, the trend of development is referred to as follows. It is becoming an increasingly well-known fact that the larger electric power installations and distribution systems can only be developed satisfactorily if planning is carried out with a view to future requirements. The opinion is held that the future development of supply systems should be entrusted to a special department of the utility company. The duty of such a department, according to American ideas, is to draw up an exact master plan setting forth the lines along which developments should take place, consideration being given to as wide a range of requirements as possible, *viz.*, reliability, simplified operation, maximum economy, network stability, and possibility of extension. The development plan should be based on accurate observation of the area to be supplied, and load curves should be plotted for the next years, so as to estimate the expected requirements, the load curves serving as a basis for calculating the size of units which it may be necessary to install and have ready. The form of the load curve is a matter of decisive importance in the distribution of the power units. The economy can be raised continually by applying increasing temperatures and pressures. While intermediate super-heating must be employed for extra-high-pressure steam (about 40 atmos.) for normal temperatures, the pressure can be raised to a certain extent by using higher initial steam temperatures, without having recourse to intermediate superheating. In this case the increase in the pressure is limited by the permissible moisture in the last turbine stage. There are no longer any constructional difficulties standing in the way of either extra-high-pressure steam or the initial steam temperature of 450 deg. C. being employed. Various opinions are expressed on the necessary readiness for service of units, whether for covering peak or instantaneous loads. Only thorough consideration of the technical and economic features of the case can show whether it is expedient in large systems to run a number of turbines on less than full load, so as to maintain an instantaneous reserve, or to employ a turbine design such as allows of sufficiently rapid starting, and so dispense with an instantaneous reserve of the above kind. With regard to the reduction of the starting-up time of a turbine, mention should be made of a new method by which it is possible to start up even large turbine sets by warming the turbine casing by the circulation of hot air. In this connection is mentioned accumulator plant and the special turbines developed for steam drop accumulators which can be utilised for covering peak loads as well as instantaneous reserves.

The Batti-Wallahs.

The opening event of the new session of the Batti-Wallahs' Society will be a luncheon at the Hotel Metropole on Thursday, October 30th, at 12.30 for 1 p.m. Sir John R. Brooke, C.B., will be the chief guest.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

We reproduce herewith the portrait of **Mr. F. Nicholls**, who, as we reported, in our last issue, has been appointed

Mr. F. Nicholls, A.M.I.E.E., M.I.Mar.E.
The new Borough Electrical Engineer, Derby.

borough electrical engineer of Derby, after serving as deputy engineer for four years.

Mr. G. H. Lake, who is leaving Derby to take up the position of city electrical engineer of Nottingham, was recently presented by the staff of the Derby Electricity Department with a Crown Derby china tea set. Mr. Lake has been with the Derby Corporation for about 30 years; he succeeded Mr. T. P. Wilmshurst as borough electrical engineer when the latter was appointed an Electricity Commissioner in 1926.

Mr. Kachichi Uchida, president of the Japan Wireless Telegraph Co., has arrived in Australia with the object of linking up the Commonwealth with Japan by means of beam wireless. Mr. Uchida is a pioneer of wireless communication in Japan.

Mr. R. Kullman has been appointed manager of the new Meter Department of Siemens Electric Lamps and Supplies, Ltd.

Mr. W. Reavell, managing director of Messrs. Reavell and Co., Ltd., recently returned from a tour which embraced Canada, Japan, and India. He is to address the British Engineers' Association at its monthly luncheon on September 11th upon the impressions gained by him during his tour of the countries mentioned.

Capt. W. J. Liberty, the hon. secretary of the Association of Public Lighting Engineers, is to receive a presentation during the annual conference of the Association at Leeds (September 8th to 11th) in recognition of his services to the Association.

Mr. Beer, the engineer of the British General Post Office, who has been in Australia to assist in establishing the radio-telephone installation for communication with England and other countries, has returned to England. At a farewell gathering of the technical branch of the postal service in Melbourne, Mr. H. P. Brown, the director-general, paid a tribute to Mr. Beer's work in Australia.

Mr. P. E. Clarke, the manager of the new electricity works of the Newry (Co. Down) Urban Council, recently applied for an increase in his salary. It was moved that he be granted an increase of £100, but the Council decided to postpone its decision until the results of the first year's working were known.

OBITUARY.

Mr. F. Wingfield.—The death occurred suddenly on August 20th, at the age of 41 years, of Mr. Frederick Wingfield, who was in business as an electrical engineer at Park Street, Croydon. He was also for many years electrical machinery superintendent at the Croydon Central Polytechnic. Up to a few months ago Mr. Wingfield was vice-chairman of the London branch of the Electrical Contractors' Association, but he had to relinquish that position on account of ill-health.

Financial Section.

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Changes, Transactions in Stocks and Shares.

New Companies Registered.

M. Grundy & Co., Ltd.—Private company. Registered August 29th. Capital, £500 in 500 ordinary shares of 10s. each and 250 7½ per cent. cumulative non-participating preference shares of £1 each. Objects: To acquire the business of radio manufacturers and dealers now carried on as "M. Grundy and Co." at 54, Clerkenwell Road, E.C.2. The directors are: May Raybould and W. J. Raybould, 94, Westmead Road, Sutton, Surrey. Secretary: E. Stewart.

Ensign Lamps, Ltd.—Private company. Registered August 29th. Capital, £100 in £1 shares. Objects: To carry on the business of manufacturers and export merchants and agents for the exportation of electrical goods, &c. The directors are: W. V. Green and J. W. Green, Staveleigh, Knott End; and F. T. Green, "Conister," Whittingham Lane, Broughton, near Preston (all manufacturers). Secretary: F. T. Green. Registered office: Starkie Street, Preston.

E. Groves, Ltd.—Private company. Registered August 29th. Capital, £500 in £10 shares. Objects: To carry on the business of electrical engineers, &c. The provisional directors are:—F. Smith, Eversley, Kings Road, Swanage, builder; Miss D. Simons, Grinstone, Dorchester; E. W. Groves, Hindustan, Court Hill, Swanage, electrician. Solicitors: J. E. M. Crowther, 23, Abingdon Street, Westminster, S.W.

Everhot Electric Co., Ltd.—Private company. Registered August 29th. Capital, £100 in £1 shares. Objects: To carry on the business of manufacturers, importers and exporters of and dealers in electrical goods and appliances, &c. The directors are:—R. Masson Smith, 18, Hampstead Way, N.W.11; W. K. Martin, 2, Warminster Square, S.E.25. Secretary: R. Masson Smith. Registered office: 9-15, Oxford Street, W.1.

Franklin Electric Co., Ltd.—Private company. Registered August 29th. Capital, £500 in £1 shares. Objects: To carry on the business of wholesale or retail dealers in electrical and wireless apparatus, &c. The first directors are:—Ethel W. Johnston, 43, Cleveland Road, Ilford, clerk; R. Heather, 25, Joan Gardens, Chadwell Heath, commercial representative. Registered office: 187-189, Ilford Lane, Ilford.

Power & Industrial Essentials, Ltd.—Private company. Registered August 29th. Capital, £500 in £1 shares. Objects: To manufacture and deal in boiler plant equipment of all kinds, engines, motors, furnaces, heating and combustion chambers, tubes, &c. The directors are:—F. S. L. Johnson, 5, Montana Road, Tooting Bec Common, S.W., engineer (managing director); J. W. Leather, 2, Vicarage Road, Handsworth, Birmingham, engineer (manager). Secretary: Doris M. Turner. Registered office: 12a, Warwick Chambers, Corporation Street, Birmingham.

Choralian Radio, Ltd.—Private company. Registered August 26th. Capital, £500 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in wireless parts and accessories, television apparatus and appliances, and general engineers, &c. The directors are: J. Bolsom, 123, Westminster Bridge Road, S.E.1, director; P. R. Cook, 15, Hillside Gardens, Wallington, Surrey, manager. Registered office: Parliament Mansions, Orchard Street, Victoria Street, S.W.1.

Austin Welding Co., Ltd.—Private company. Registered August 26th. Capital, £1,500 in £1 shares. Objects: To carry on the business of electric, gas, and general welders, &c. The subscribers are: T. E. Browne, 75, Casimir Road, Upper Clapton, E.5, law clerk; W. McEwen, 114, Olyffe Avenue, Welling, Kent, solicitor's clerk. Registered office: 49, Hoskin Street, Newport, Mon.

Provincial Electrical Services, Ltd.—Private company. Registered August 27th. Capital, £100 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in magnetos, dynamos, starters, batteries and appliances of every kind for ignition or starting in connection with internal combustion engines, &c. The subscribers are: T. Freeman, "Glenroy," Anchorage Road, Sutton Coldfield, accountant; G. H. Cockin, "Highgate," Haden Hill, Old Hill, Staffs, solicitor. Acting secretary, G. H. Cockin. Registered office: 316, Farm Street, Hockley, Birmingham.

Long & Carter, Ltd.—Private company. Registered August 28th. Capital, £1,300 in £1 shares. Objects: To acquire the business of electrical engineers and contractors carried on by M. S. Long and A. H. Carter, as "Long & Carter" at 61, Wenham Drive, Westcliff-on-Sea, and Southend Road, Wickford, and to carry on this and the business of radio and gramophone merchants, dealers in dynamos, motors, and other electrical appliances, &c. The directors are: M. S. Long, 61, Wenham Drive, Westcliff-on-Sea, engineer; A. H. Carter, "Roen Burt," Huntingdon Road, Thorpe Bay, engineer; W. A. Howell, Bridge House, Wickford. Secretary: M. S. Long. Registered office: 61, Wenham Drive, Westcliff-on-Sea.

Hartlepools Radio Relay, Ltd.—Private company. Registered August 28th. Capital, £1,000 in £1 shares. Objects: To construct, establish and maintain wireless signal stations and all other stations for the reception or distribution of wireless or radio signals, &c. The directors are: G. Holdsworth, 1, Gladstone Street, Hartlepool; J. Muscott, 58, Coal Clough Lane, Burnley. Solicitors: Arthur Geipel & Bailey, West Hartlepool.

Official Returns of Electrical Companies.

Pirelli-General Cable Works, Ltd.—Satisfaction in full on July 1st, 1930, of trust deed dated March 19th, 1923, and registered March 23rd, 1923, securing £300,000 6 per cent. first mortgage debenture stock. Particulars filed of £600,000 debenture stock and premium of 5 per cent. authorised June 11th and covered by trust deed dated July 1st, 1930, the whole amount being now issued. Property charged: Certain freehold and leasehold properties at Southampton and Eastleigh and the company's undertaking and other assets, present and future. Trustees: British Trusts Association, Ltd., 32, Bishopsgate, E.C.2.

North Metropolitan Power Station Co., Ltd.—Particulars filed of £850,000 second mortgage debenture stock authorised July 31st, and covered by trust deed dated August 19th, 1930, the whole amount being now issued. Property charged: Certain freehold land and buildings at Enfield, rentals or other sums receivable by the company under an agreement dated October 5th, 1926, or under a lease dated February 2nd, 1927, and the company's undertaking and other property, present and future, including uncalled capital (subject to trust deed dated February 25th, 1927). Trustees: Baring Bros. and Co., Ltd.

Industrial Engineering, Ltd. (formerly Brilliant Arc Lamp and Engineering Co., Ltd.).—Satisfaction to the extent of £1,983 16s. 7d. on August 10th, 1930, of debenture stock issued to the amount of £5,383 16s. 7d., secured by trust deed dated February 18th, 1928, and registered February 24th, 1928.

Ramsden Green, Ltd.—A. J. Carey, 49, Queen Victoria Street, E.C.4, ceased to act as receiver on August 22nd, 1930.

Instrument Wires & Cables, Ltd.—F. W. Paterson, 35, Great Tower Street, E.C.3, ceased to act as receiver on August 19th, 1930.

Tamworth District Electric Supply Co., Ltd.—Particulars filed of £90,000 debentures authorised July 8th, 1930, charged on the company's property, present and future, including uncalled capital, the amount of the present issue being £70,000.

British Hanovia Quartz Lamp Co., Ltd.—Capital, £25,000 in £1 shares. Return dated April 21st, 1930. All shares taken up. £20,500 paid. £4,500 considered as paid. Mortgages and charges, nil.

John Spencer, Ltd.—Capital, £75,000 in 10,000 preference and 5,000 ordinary shares of £5 each. Return dated July 22nd, 1930. 10,000 preference and 1,027 ordinary shares taken up. £55,135 paid. Mortgages and charges, £25,000.

Central Sussex Electricity, Ltd.—Capital, £30,000 in £1 shares. Return dated June 25th, 1930. All shares taken up. £30,000 paid. Mortgages and charges, nil.

Yeovil Electric Light & Power Co., Ltd.—Capital, £75,000 in £1 shares. Return dated April 28th, 1930. 65,000 shares taken up. £65,000 paid. Mortgages and charges, nil.

British Thomson-Houston Co., Ltd.—Capital £4,000,000 in 2,000,000 7 per cent. cumulative preference and 2,000,000 ordinary shares of £1 each. Return dated April 30th, 1930. 1,500,000 preference and 2,000,000 ordinary shares taken up. £3,425,310 paid. £74,690 considered as paid. Mortgages and charges, £1,506,706.

Hexham & District Electric Supply Co., Ltd.—Capital, £45,000 in 7,605 "A," 6,479 "B," and 30,916 "C" shares of £1 each. Return dated May 12th, 1930. 7,605 "A," 6,479 "B," and 27,467 "C" shares taken up. £34,918 paid. £154 calls unpaid. £6,479 considered as paid. Mortgages and charges, £25,050.

Wolverhampton & District Electric Tramways Ltd.—Capital, £200,000 in £5 shares. Return dated June 11th, 1930. 32,200 shares taken up. £159,812 10s. paid (being £5 per share on 31,950 shares and 5s. per share on 250 shares). Mortgages and charges, £26,585.

Harris, Williams (Manufacturers), Ltd.—Debenture dated August 13th, 1930, to secure £7,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holder: T. Hall, 37, Groat Market, Newcastle-upon-Tyne.

Richson & Co. (1925), Ltd.—Capital, £15,000 in £1 shares. Return dated June 25th, 1930. 14,660 shares taken up. £2 paid, £14,658 considered as paid. Mortgages and charges, nil.

Welding Equipment, Ltd.—Mortgage and debenture constituting a first floating charge on the company's undertaking and property, present and future, including uncalled capital and goodwill, dated August 12th, 1930, to secure all moneys due or to become due from the company to the District Bank, Ltd.

City Notes.

Grosvenor Electric Batteries, Ltd.

The statutory report shows that the number of shares allotted is 15,000 6 per cent. cumulative redeemable preference and 34,000 ordinary, of which 19,000 ordinary are allotted as paid up in consideration of the purchase of the assets and undertaking of the Grosvenor Battery Co., Ltd. The total amount of cash received in respect of shares issued wholly for cash is £30,000. Preliminary expenses amount to £1,387, stockbrokers' commission, £375, purchase of shares in Adie and Co., with stamp duty, £4,545, prospectus and stockbrokers' fees, £662, excess of payments over receipts to August 26th, £1,358, and deposit (10 per cent.) paid on purchase of property at Watford, £600. Balance in hand, £21,072. Meeting: September 9th.

Cia de Electricidad de la Provincia de Buenos Aires.

Reference is made in the recently-issued report to the acquisition of an important interest in the company by the "Sofina." The proceeds of the sale to the South American Power Co. of the control of six generating stations will be used partly to redeem the 5 per cent. first mortgage gold bonds. The net profit for 1929 declined from £163,699 to £108,923; after meeting the 8 per cent. dividends on the preference shares and directors' remuneration, a balance of £12,728 (against £70,301) is placed to reserve.

Associated Gas & Electric System.

The gross earnings and other income for the year ended July 31st last totalled $108,050,904, as against $65,784,842 in the previous year, and the total operating expenses, &c., were $59,927,734 ($38,999,417), the net earnings being $48,123,170 ($26,785,425). After deducting underlying dividends and interest, &c., there was a credit balance of $19,353,098 ($9,224,143).

Crompton Parkinson, Ltd.

The directors propose to increase the capital to £826,000 by the creation of 600,000 "A" ordinary shares of 5s. each which will not carry voting rights.

Ward & Goldstone, Ltd.

The directors announce the payment of the usual interim dividend for the half-year on the cumulative preference shares at the rate of 7 per cent. per annum, on September 30th.

British Columbia Power Corporation.

The regular dividend of $0.50 per share has been declared on the "A" shares of no par value for the quarter ending September 30th.

Clarke, Chapman & Co., Ltd.

An interim dividend has been declared on the ordinary shares of 3 per cent., less tax (same).

Brazilian Traction, Light & Power Co., Ltd.

A quarterly dividend of 1½ per cent. has been announced on the cumulative preference shares.

Pennsylvania Water & Power Co.

A dividend of $0.75 per share has been declared on the common shares for the quarter ending September 30th.

Stocks and Shares.

TUESDAY EVENING.

So rapid a change-over from depression to cheerfulness as that which has occurred during the past week, the Stock Exchange has not seen for many a long day. The complete agreement that pessimism had been overdone was followed up by a little practical interest in the shape of buying on the part of the public, with the result that the bears in the markets of the Stock Exchange took fright, and, in their efforts to get back stock which they had sold, they disclosed the scarcity of floating supplies, and brought about a surprising recovery in prices. Rumour assisted the improvement by vague talk of the possibility of a 10 per cent. import duty being imposed within the comparatively near future, to which was added gossip of a Coalition Government, and a determined effort being made to reduce the cost of the dole by the process of giving assistance in kind instead of in money. No report was too wild for it to receive consideration, and the result has been an all-round rally in prices.

Electricity Issues.

So far as this concerns the stocks and shares with which we deal in these pages, the result has been less dramatic than in a good many other departments, for the simple reason that the majority of Stock Exchange securities treated here are of the purely investment order, and these have resisted, in the majority of cases, the tendency which has been noticeable for the past eight months. Indeed, the market for home electricity supply shares is one of the very few that held its ground throughout the industrial depression, while the purely gilt-edged stocks, like the home electricity supply shares, are mostly better in price than they were at the beginning of the year. Nevertheless, Cables and Wireless stocks show very dramatic rises since a week ago.

Home Electricity Supply.

In those few cases in this list in which speculative interest prevails, improvements have taken place. For example, County of London ordinary recovered to 45s., Metropolitan Electrics are better at 40s., and various provincial shares have participated in the advance. Amongst the last-named are included Bournemouth and Poole, Lancashire Light and Power, and Midland Counties. On the other hand, Midland Electric Power shares have gone back to 30s. Various dividend deductions which were made from prices on the last Stock Exchange Account Day—Thursday in the previous week—have been recovered. Northamptons are better at 41s., Egham and Staines at 30s. Newcastle and District are at 25s. British Power and Light shares have gained a few pence, being up to 14s. 9d. The tendency of the market is described as good, and dealers report that they have little stock to offer. In the Indian list, Calcutta Electric ordinary strengthened to 44s. 3d.

Investment Stocks and Shares.

County of London 5 per cent. debenture stock has hardened to 102½, at which there is still stamp-free stock to be obtained. Edumundsons' Electricity Corporation 5 per cent. debenture is a shade easier at 97 offered. Newcastle-on-Tyne 5 per cent. debenture stock holds its premium at 4½. North Metropolitan Power 5 per cent. second debenture is offered at 100½, free of stamp; London Electric Railway 5 per cent. debenture is firm at 4½ premium above the issue price of 97½.

In the preference group, 2,000 General Electric 7½ per cent. "B" preference can be bought at 26s. 3d., with dividends due at the end of June and December. The return on the money is £5 14s. 3d. per cent. The dividend on the stock requires £135,000 per annum. On last year's figures, the General Electric Co., Ltd., had £744,000 available. There are also on offer 1,000 British Thomson-Houston 7 per cent. cumulative preference shares at 22s. 9d., which yield £6 3s. per cent. on the money. Dividends are payable on the 15th June and December. Last year's profits came to £320,000. The dividend on these shares takes £84,000 per annum. About 500 Electric Construction 7 per cent. preference can be bought at 21s. 6d., paying 6½ per cent. Crompton Parkinson 6 per cent. second preference are in the market at 19s. 6d., this affording a return of £6 3s. per cent. on the money, dividends being due at the end of March and September. The dividend service for these shares requires £19,606, and last year's profits were £101,900. It is proposed to create 600,000 shares of 5s. each, to be known as "B" shares, and carrying no voting rights. New articles of association are to be adopted if the necessary resolutions are passed at the meeting on September 18th.

Cables and Wireless.

Stocks which in our list show more appreciably than any others the change of sentiment that has occurred in Stock Exchange markets are Cables and Wireless preference and ordinary. The 5½ per cent. stock has risen 8 to 80½, the "A" ordinary stock at 28½ shows a similar gain, while the "B" ordinary is 7 higher at 17. The market was obviously oversold, and the publication of figures by the Imperial and International Communications, showing an increased traffic of £24,000 for July over that of June, helped to stimulate the remarkable recovery which has occurred. There were, it may be observed, a good many people who, having

sold Cables and Wireless preference at higher prices, were on the look-out for an opportunity to repurchase the stock at what they considered likely to prove the lowest levels reached. No doubt a good many of these prospective purchasers are regretting that they did not get in when Cables preference dropped to 72, but the turn round in sentiment had the effect of bringing in a good many small buyers, and the price jumped a couple of points within an hour. The market continues in a highly sensitive condition. Indications suggest that investment is regarding the preference stock with a more favourable eye than it has done since the unfortunate report appeared that caused the violent break. As the stock carries a six months' dividend payable immediately, it is regarded as one of those securities which, put away for a year or two, is likely to show its possessor a substantial profit. Globe Telegraph ordinary advanced to 15¾ in sympathy. Anglo-American Telegraph preferred and deferred stocks are both better, the former rising to 101, and the deferred to 25. There is a little inquiry for International Automatic Telephones, and the price has hardened to 31s. 6d. The "B" deferred are 30s. 6d. American Telephone and Telegraph strengthened to 220, after being 5 points lower. International Telephone and Telegraph is quoted at 42½. Anglo-Portuguese Telephones have been changing hands about 19s. 3d. Postal Telegraph 5 per cent. debentures at 88 show no change, and Cable Telegraph and General Trust preference remain at 20s. 6d.

Home Railway Stocks.

After a very violent rise in the prices of steam stocks, the market for Home Railway issues turned a little reactionary, though substantial advances are left on the week. The Southern Railway issues came into demand because of the electrification which the company is pursuing with such vigour, and which, as already noted here, is considered to bring the Southern into the list of electric railways. Metropolitan consolidated stock has gone back a little, but, on the other hand, Districts are a point to the good at 76. Underground Electric income bonds were quoted ex the half-yearly interest on Monday in this week, and the price is now 104 xd. The company's 6 per cent. first income debenture stock changed hands the other day at 103¼, while the 5 per cent. first mortgage debenture stock stands at 99 middle, at which price it is more readily sold than bought. Central London assented ordinary at 77 xd is slightly harder, allowing for the deduction of the dividend.

Manufacturing and Equipment Shares.

Shares in the manufacturing group are showing distinct signs of convalescence after the weakness which recently attacked them by reason of sales made by holders pressed for money. The importance of value begins to assert itself once more. In a Stock Exchange slump, the merits of a company frequently go by the board if it should happen that shares in that undertaking are held by people who are called upon to provide cash to meet other obligations. The fall in the first-class electrical manufacturing and equipment companies' shares was overdone. Enfield ordinary are better at 4 1/16 xd, British Insulated ordinary have risen to 3½. Henleys, after a drop to 5¾, recovered to 5¼. A rise of 10s. in Telegraph Constructions lifted the price to 19. G.E.C. ordinary gained 1/9 at 48s. 9d. Associated Electrical Industries ordinary shares at 28s. 9d. are 6d. higher. The same disposition is noticeable amongst the iron, steel, and allied shares. Babcock & Wilcox jumped from 50s. to 54s. 6d. Vickers rose from 6s. 9d. to 7s. 3d. Notwithstanding the heaviness of rubber—the product—a mild improvement occurred amongst shares in rubber-producing companies. In some of these cases, the amount of business responsible for the recovery has been slender, the prices being marked up almost automatically on the appearance of a little demand. Crompton Parkinsons are unchanged at 23s. 9d. Philips Lamps remain about 2¼. Falls of 1/16 have lowered English Electric ordinary to 12s. 6d., the preference to 10s.

Latin-American.

Brazilian Tractions spurted 4 to 36½, upon a greatly-improved tone in New York. Hydro-Electrics have risen to 38½: International Holdings to 4¼. American utility companies continue to show increased returns. The Associated Gas & Electric System reports a credit balance, for the year ended July 31st, of 19,353,000 dollars, being ten million dollars higher than that of the preceding twelvemonth. The president of another large American utility company, over here for a holiday, said in a personal talk last week that industrial conditions in the States had taken a definite turn for the better. Business, he declared, is looking up in most trades, and people are beginning to invest money once more in bonds and shares. Power Corporation of Canada shares are 2 higher at 69: Shawinigan common at 67½ show a point advance. The Mexican division exhibits a firmer tendency, following a substantial rise in Mexican Government issues. Amongst other foreign traction descriptions, Anglo-Argentine Trams failed to recover their recent heavy loss. Speaking generally, however, the Stock Exchange markets are in a cheerful, not to say a buoyant condition, despite a volume of business that is disproportionately meagre to the material price-advances that have occurred since a week ago.

Share List of Electrical Companies.

Home Electricity Companies.

	Nom.	Approx. Dividend. 1928.	1929.	Price Sept. 2 1930.	Rise or fall	Yield p.c.
	£					
Bournemouth and Poole	1	15	15	67/6	+1/16	5 4 3
Brompton Ordinary	1	8½	8½	26/6xd	+6d.	5 5 8
Charing Cross Ordinary	1	8½	8½	27/6	—	5 1 10
do. do. 4½% Pref.	1	4½	4½	18/-	—	5 0 0
Chelsea	1	8½	8½	26/6	—	5 5 8
City of London	1	10	10	33/9	—	4 3 1
do. do. 6% Pref.	1	6	6	23/6	—	5 2 2
Clyde Valley	1	8	8	38/3	—	4 3 9
County of London	1	7	10	45/-	+1/16	4 9 0
do. do. 6% Pref.	1	6	6	23/6	—	5 2 2
Edmundson's 7% Pref.	1	7	7	24/-	—	5 16 8
Elec. Supply Corporation	1	11	11	48/3	—	4 11 3
Kensington Ordinary	1	8	8	27/-	—	5 3 8
Lancs. Light and Power	1	7½	7	24/-	+6d.	5 16 8
London Electric	1	8½	9	30/-	—	4 13 4
Metropolitan	1	9	10	40/-	+6d.	5 0 0
do. 4½% Pref.	1	4½	4½	17/-	—	5 6 0
Midland Counties	1	6½	7	27/6	+1/-	5 1 10
Mid. Elec. Power	1	15	8	30/-	—1/8	5 6 8
Newcastle-on-Tyne Ordinary	1	6	6	22/6	—	5 6 8
do. 7% Pref.	1	7	7	27/-	—	5 3 8
Notting Hill 6% Pref.	10	6	6	10½	—	5 11 4
North Met. Elec. 6% Pref.	1	6	6	23/6	—	5 2 2
St. James' and Pall Mall	1	8	8	27/6	—	5 1 10
Scottish Power	1	8	8	28/-	—	5 14 4
South London	1	8½	8½	27/6	—	5 1 10
Urban Ordinary	1	7	7	27/6	—	5 1 10
Westminster Ordinary	1	8½	8½	27/-	—	5 8 8
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	24/6	—	6 2 5
Yorkshire Elec.	1	8	8	31/3	—	5 2 5

Home Rails.

Central London Ord. Assented	Stock	4	4	77xd	+½	5 4 0
Metropolitan	,,	3½	4	67½	—½	5 18 6
do. District	,,	4	5	76	+1	6 11 7
Underground Electric	£1	7	8	23/6	—	6 16 2
do. do. Income	Bonds	6	6	104xd	—	5 15 5

Telegraphs and Telephones

Anglo-Am. Tel. Pref.	Stock	6	6	101	+1	5 19 0
do. Def.	,,	1½	1½	25	+¾	6 0 0
Automatic Telephone	1	10	12½	35/-	—	7 2 10
Cables & Wireless 5½ Pref.	Stock	—	5½	80½	+8	6 16 8
do. A 7½ Ord.	,,	—	—	28½	+8	... ...
do. B Ord.	,,	—	—	17	+7	... ...
Globe Tel. and T. Ord.	10	10	10	15¾	+¼	*6 7 0
do. do. Pref.	10	6	6	10¾	—	5 11 7
Great Northern Tel.	10	20	20	29½	—	6 15 7
Marconi-Marine	1	12½	15	36/3	—	8 5 8
Oriental Telephone Ord.	1	12	12	51/3	—	*4 13

Home and Foreign Trams, &c.

Anglo-Arg. Trams First Pref.	5	5½	5½	2⅛	—	13 6 8
do. do. 2nd Pref.	5	6	6	1¾	—	17 8 0
do. do. 5% Deb.	Stock	5	5	55	—	8 18 6
British Electric Traction Def. Ord.	,,	5	5	1450	—	... ...
do. do. Pref. Ord.	,,	8	8	129½	—	6 6 6
Brazil Traction	100	7	8	36½	+4	5 9 7
Brit. Columbia Elec. Rly. Pfd.	Stock	5	5	91½	—	5 9 8
London & Sub. Trac. 5% Pref.	1	Nil	Nil	9/-	—	... ...
London United Tram Deb.	Stock	4	4	53½	—	7 12 4
Mexico Trams, 5% Bonds	—	5	5	57xd	—	8 15 6
Mexican Light Common	100	Nil	Nil	62½	—	... ...
do. 7% Pref.	100	7	7	76½	—	9 3 0
do. 1st Bonds	—	5	5	79	—	6 6 7
Victoria Falls Ord.	1	15	15	58/9	—	5 2 0
Yorkshire (West Riding)		Nil	Nil	5/-	—	... ...

Manufacturing Companies.

Assoc. Elec. Ord.	1	6	6	28/9	+6d.	5 1 1
Babcock & Wilcox	1	13	15	54/6	+4/6	*5 10 1
British Aluminium Ord.	1	10	10	39/6	+9d.	5 1 8
British Elec. Transformer Pref.	1	7	7	9/9	—	... ...
British Insulated Ord.	1	15	15	3⅞	+1/16	4 7 3
Brush Ord.	Stock	10	10	105	—	9 10 6
Callenders	1	15	15	3⅛	—	4 12 4
do. 6½% Pref.	1	6½	6½	23/9	—	5 9 5
Crompton Parkinson Ord.	5/-	—	80	23/9	—	6 6 4
do. 8% Pref.	1	8	8	25/9	—	6 4 3
Edison-Swan 1st. Pref.	1	7½	7½	26/3	—	5 14 3
do. 5% Deb.	Stock	5	5	84½	—	5 18 4
Electric Construction	1	5½	5	12/-	—	8 6 8
Enfield Cable Ord.	1	20	25	4¼xd	+1/8	6 3 5
English Electric	1	Nil	Nil	12/6	—1/16	... ...
do. do. Pref.	1	3	Nil	10/-	—1/16	... ...
Gen. Elec. Pref.	1	6½	6½	23/9	—	5 9 5
do. Ord.	1	10	14	48/9	+1/9	5 14 9
Henley	1	25	30	5¾	—	5 9 1
do. 4½% Pref.	5	4½	4½	4¼xd	—1/6	5 6 0
India-Rubber	1	Nil	Nil	7/6	—	... ...
Johnson & Phillips	2	10	10	1¾	—	5 6 8
Siemens Ord.	1	7½	7½	22/-	—	6 16 4
Telegraph Construction	12	10	10	19	+½	*6 6 7

* Dividends paid free of Income Tax.

Swedish Electrical Imports.

Statistics for 1928 and 1929 Compared.

THE following figures, showing the values of Sweden's imports of electrical and allied goods during 1929, are taken from the recently-published official trade returns. For purposes of comparison the figures for 1928 are given and notes of increases or decreases are made. Details of Sweden's electrical exports during last year appeared in our last issue (p. 354).

	Kroner. Thous. 1928.	Kroner. Thous. 1929.	Kroner. Thous. Inc. or dec.
Accumulators and parts thereof—unmounted cells—			
Total	355	88	− 267
From Germany	338	51	− 287
Accumulator plates—			
Total	424	566	+ 142
From Denmark	18	22	+ 4
,, Germany	341	420	+ 79
,, Great Britain	8	33	+ 25
,, U.S.A.	56	80	+ 24
Cells and batteries, wholly or partly mounted—			
Total	942	670	− 272
From Denmark	36	48	+ 12
,, Germany	463	215	− 248
,, Great Britain	126	115	− 11
,, U.S.A.	304	280	− 24
Special apparatus for electrical purposes: Röntgen ray apparatus—			
Total	293	233	− 60
From Germany	273	216	− 57
Wireless telegraph and telephone apparatus—			
Total	5,119	2,531	−2,588
From Germany	2,468	883	−1,585
,, Great Britain	520	476	− 44
,, U.S.A.	109	57	− 52
Other special apparatus for electrical purposes—			
Total	3,884	6,910	+3,026
From Denmark	129	225	+ 96
,, Germany	2,225	3,740	+1,515
,, Great Britain	1,105	1,930	+ 825
,, Switzerland	85	120	+ 35
,, U.S.A.	198	445	+ 247
Galvanic cells—			
Total	3,577	3,195	− 382
From Denmark	2,020	1,780	− 240
,, Germany	1,460	1,310	− 150
Vacuum cleaners—			
Total	297	376	+ 79
From Germany	266	330	+ 64
Generators and motors, weighing not more than 500 kilos each—			
Total	2,525	3,840	+1,315
From Denmark	134	156	+ 22
,, Germany	1,714	2,550	+ 836
,, Great Britain	131	211	+ 80
,, U.S.A.	426	646	+ 220
Ditto, weighing more than 500 but less than 3,000 kilos—			
Total	793	602	− 191
From Denmark	96	75	− 21
,, Germany	96	380	+ 284
,, Great Britain	60	26	− 34
Ditto, weighing more than 3,000 kilos—			
Total	196	187	− 9
From Germany	158	122	− 36
Transformers, 100 to 500 kg.—			
Total	58	72	+ 14
From Germany	32	45	+ 13
Transformers, 500-3,000 kg.—			
Total	69	96	+ 27
From Germany	44	63	+ 19
Transformers, over 3,000 kg.—			
Total	174	332	+ 158
From Germany	140	270	+ 130
,, Switzerland	28	49	+ 21
Metal-filament lamps—			
Total	3,673	3,716	+ 43
From Denmark	109	112	+ 3
,, Germany	2,188	2,745	+ 557
,, Netherlands	748	337	− 411
,, Austria	120	56	− 64
Lamp sockets, with and without switches—			
Total	461	523	+ 62
From Germany	433	470	+ 37
Insulating tubes—			
Total (nearly all from Germany)	550	410	− 140
Carbon, not specially mentioned, for electrical purposes, weighing 3 kilos or more—			
Total	1,159	1,812	+ 653
From Germany	504	936	+ 432
,, U.S.A.	619	857	+ 238
Carbon brushes—			
Total	85	247	+ 162
From Germany	20	38	+ 18
,, Great Britain	52	174	+ 122
Carbon: Other kinds—			
Total	233	125	− 108
From Germany	174	103	− 71
,, U.S.A.	34	6	− 28
Starting, regulating, and reduction resistances, controls, and other electric regulators—			
Total	350	660	+ 310
From Germany	278	507	+ 229
Bases for incandescent lamps—			
Total	94	112	+ 18
From Germany	32	60	+ 28
,, Netherlands	62	52	− 10
Stators, rotors, current collectors, magnet coils, &c., weighing not more than 50 kilos—			
Total	518	330	− 188
From Denmark	16	27	+ 11
,, Germany	416	195	− 221
Current interrupters and reversers, oil-break switches, hand-operated—			
Total	77	189	+ 112
From Germany	53	108	+ 55
,, Great Britain	9	19	+ 10
Box, knife and other switches—			
Total	1,318	1,880	+ 562
From Germany	1,068	1,420	+ 352
Safety appliances, not specified—			
Total	831	846	+ 15
From Germany	815	825	+ 10
Electricity meters—			
Total	1,197	1,284	+ 87
From Germany	1,059	1,135	+ 76
,, France	72	97	+ 25
Other electrical measuring instruments—			
Total	630	818	+ 188
From U.S.A.	52	71	+ 19
,, Germany	501	665	+ 164
Cables and cords with sheaths of lead or other metal; maximum diameter 25 mm.—			
Total	783	1,208	+ 425
From Denmark	76	122	+ 46
,, Germany	679	1,061	+ 382
Ditto, of greater diameter—			
Total	1,327	1,493	+ 166
From Denmark	99	116	+ 17
,, Germany	1,227	1,375	+ 148
Ditto, not specified—			
Total	1,638	1,390	− 248

(£1 = about 17 kr.)

The 1930-31 Lighting Season.—II.

Some details of the "Philips," "Siemens," "Osram," and "Royal Ediswan" Campaigns. E.L.M.A announces price reductions.

THE plans of PHILIPS LAMPS, LTD., for the coming season are set out in a folder which also contains illustrations of the various "sales aids" which the company has produced for use by retailers. This year's window display takes the form of a three-panelled screen; this is 3 ft. 10 in. in height, the centre panel measures 2 ft. 10 in. by 2 ft., and

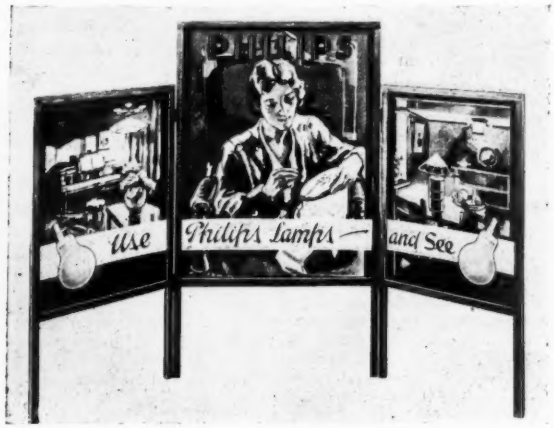


Fig. 3.—A Philips Window Screen.

the side panels 2 ft. by 1 ft. 6 in. It is proposed to issue at intervals of a few weeks a series of showcards for mounting on this screen. The first group of the series is shown in fig. 3. The pictures are produced in striking colours and are very artistic in conception. Another group which is to be issued early in the season depicts a Philips lamp in the centre panel, the side panels bearing pictures of domestic interiors. The window display will be completed by means of streamers and cut-outs, some of which are illustrated in the folder and are seen to be of a very attractive nature. For stimulating the sale of its automobile lamps the company has prepared a special window display (fig. 4) in which a simple arrangement of cartons and a messenger-boy cut-out produce a very effective ensemble. Another device which retailers may obtain at small cost is a "silent salesman" taking the form of a cabinet with sloping top into which various types of lamps can be fitted for demonstration purposes. In addition to these larger aids," a good selection of pamphlets, arranged for overprinting, is available.

SIEMENS ELECTRIC LAMPS & SUPPLIES, LTD., has decided to retain the "Popular Pair" in its 1930-31 advertising. These are two children—a boy and a girl—carrying, respectively, an opal and a pearl lamp. This year a number of window displays will be available in which the "Popular Pair" will be "featured" in eleven colours. Each of these forms a complete display in itself and when it is opened out the figures of

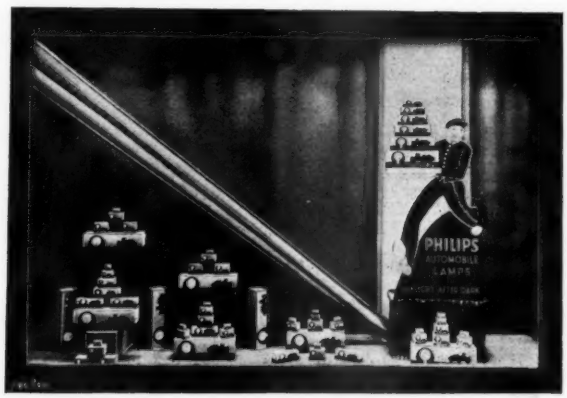


Fig. 4.—An Automobile Lamp Display.

the two children stand out from the background. One of these displays is illustrated in fig. 5. The principal showcard is of similar design. During the season 16-sheet posters, as shown in fig. 6, will appear in London and all the important towns in Great Britain and Ireland. This, as will be seen, is made to serve a double purpose, advertising "Siemens" batteries as well as lamps. There will, of course, be leaflets for the retailer's use overprinted with his name and address. A neat device which is also being supplied is a leaflet stand which is backed by a large skeleton lamp in which representations of "Silvalux" and pearl lamps are apparently suspended without support—the illusion being obtained by the use of a very fine net background.

Fig. 5.—A Siemens Window Display.

Fig. 6.—The Siemens Poster.

The plans of the GENERAL ELECTRIC CO., LTD., have for their principal object the elimination of all types other than "Pearl Osram" lamps for general lighting service, and the raising of the demand for the "simplified line" of these lamps to within reach of the ultimate goal of 100 per cent., thus giving the retailer only one line of lamps to stock. The energetic efforts

made by the company to establish the "simplified line" two years ago resulted at the end of the first year in a step of 34 per cent. towards standardisation. At the end of the second year this figure was actually doubled. Hence the optimism that, with the third year, the figures will approximate closely to 100 per cent. The big change-over from sixty-five miscellaneous types

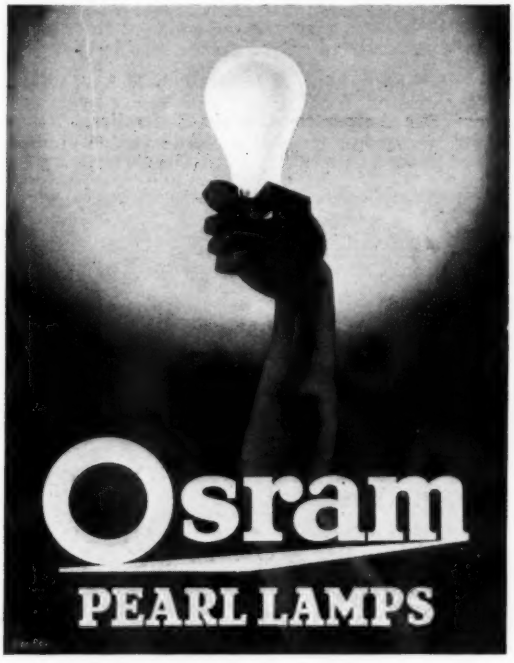


Fig. 7.—The 1930-31 "Osram" Design.

of lamps to the five which constitute the "Osram" simplified line has meant radical alterations in manufacturing arrangements, and in order to meet the ever-growing demand the G.E.C. has erected a very large new factory at Wembley.

The publicity campaign of the company will embrace advertising in most of the important London and provincial daily papers, home and class weekly and monthly magazines, trade and industrial journals, as well as the electrical trade Press. Following the procedure of previous years the trade is being apprised by means of an attractively designed broadsheet

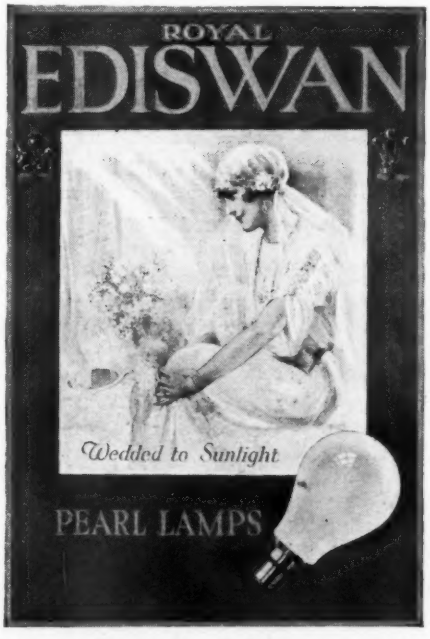


Fig. 8.—The "Royal Ediswan" Poster.

as to the company's advertising and sales campaign. This broadsheet directs, among other things, the trade's attention to the numerous "sales helps" which have been prepared to stimulate demands for the simplified line. These sales helps include a showcard in striking colours, various folders and leaflets and sundry display material. Again this year a window display service has been arranged for the benefit of dealers.

The device by which "Osram" will be impressed upon the public mind this season is illustrated in fig. 7. It symbolises light combined with strength.

A very attractive poster design is the central idea in this season's lamp propaganda of the EDISON SWAN ELECTRIC CO., LTD. This is a picture of a rather charming bride and bears the inscription "Wedded to Sunlight"; a reproduction appears in fig. 8. A neat and effective window display has also been designed and an illustration of it appeared in our issue of August 8th (p. 219). The centrepiece of this is a fountain scene which is illuminated and animated. The display is completed by a simple arrangement of "Royal Ediswan" cartons and a coloured paper background. A useful little booklet entitled "Electricity: Its Use in Your Home" is being issued to customers. This sets forth the many domestic uses of electricity, illustrates a number of examples of modern lighting fittings and electrical appliances, and also contains hints on the safe use of electricity, meter reading, &c. Special publications have been produced in connection with the company's automobile lamps and anti-glare shields and fog disks are being given to motorists. There are also, of course, price lists for overprinting and a selection of showcards available. Other sales aids of a special nature are day and night box signs and a puzzle novelty.

Lamp Prices Reduced.

As we foreshadowed in our last issue, the prices of a number of types of lamps produced by members of the Electric Lamp Manufacturers' Association were reduced as from the first of

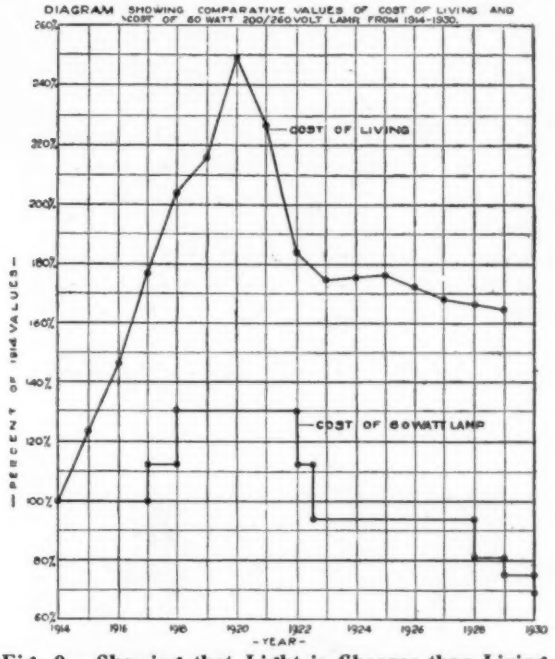


Fig. 9.—Showing that Light is Cheaper than Living.

the month. The makes affected are the following:—"Bell," "Cosmos," "Cossor," "Cryselco," "Elasta," "Foster," "Mazda," "Neron" "Orion," "Osram," "Philips," "Royal Ediswan," "Siemens," "Stearn," "Stella," "Tungsram," and "Z." A notable feature of the new list is the abolition of the slightly lower price for "pearl" lamps for the standard voltage (230 V). The reduction in the case of the lower-wattage lamps is 1d. or 2d., but in the case of the 75-W pearl lamp it is as much as 9d., and even more is taken off the prices of some of the larger patterns.

These reductions, coupled with the ever-falling price of electrical energy, should lead to a great advance in domestic and commercial lighting. The scope is undoubtedly of tremendous proportions and, as we are showing in these articles, the leading makers are doing their utmost to assist dealers to get the business.

An interesting curve prepared by E.L.M.A. is reproduced in fig. 9. This compares living costs from 1914 right through the war period up to the current year with the cost of electric lamps during the same period. The 60-W size is taken as being the most popular. From the curve it will be seen that although the cost of living went up to about 250 per cent. of the pre-war figure in 1920, the price of the 60-W lamp was never more than 130 per cent. of the 1914 price. In 1922, when the cost-of-living index was in the neighbourhood of 180, the price of the 60-W lamp actually fell below the pre-war level and after remaining at about 93 per cent. for 5½ years fell by three steps to the present figure of 70 per cent. of the pre-war price.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this section.

A Street Traffic Control System.

The "A.T.M." system for the control of street traffic by colour light signals has been developed by AUTOMATIC TELEPHONE MANUFACTURING CO., LTD., Strowger Works, Liverpool, in compliance with the recommendations of the Ministry of Transport. The signal lanterns are of simple and robust construction. They are arranged in groups of three, comprising the now familiar combination of colours—red, amber, and green—and are assembled in boxes of various types to suit local conditions and methods of mounting. The actual signal lamps are of 60 watts rating, and they are placed at the focus of efficient spun-copper reflectors, the reflecting surface being obtained by highly polished chromium plating. In front of the lamps, and supported by the housing, are suitably coloured diffusing lenses. The lanterns are cowled to augment visibility and counteract the neutralising effect of bright sunshine. Installed at the intersection of two or more roads the signals operate in accordance with the now accepted practice. In the automatic control of the signals, the setting of the ratios of

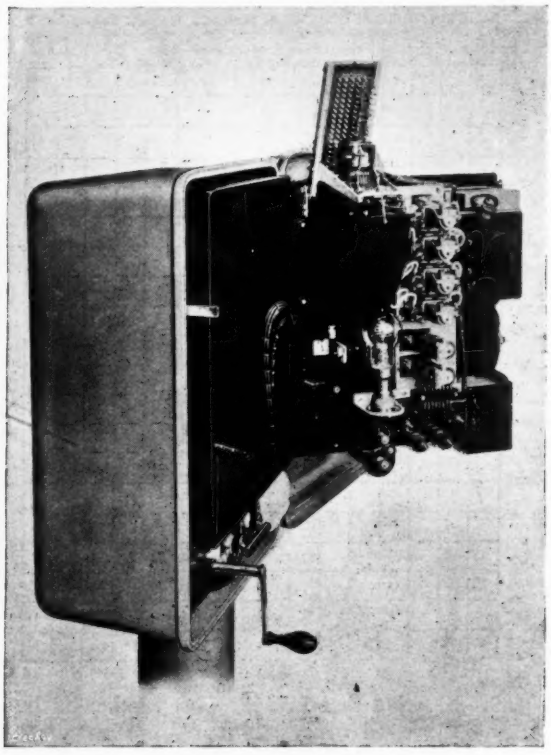


Fig. 1.—A.T.M. Controller, showing "Strowger" Line-switch and Mechanism.

main to cross-road traffic, the synchronisation of the signals, &c., the "A.T.M." system is claimed to be essentially novel, the mechanism consisting almost entirely of standard "Strowger" automatic telephone exchange components. Its simplicity may be gauged from the fact that the number of moving parts in the controller at each crossing is limited to one "Strowger" rotary line-switch and seven relays. There are two types of the control equipment, operating on the same principle and differing only in points of detail. The first control signals at an isolated intersection of main and cross roads, whilst the second is designed for the control of successive signals at a series of interdependent intersections, defined by the Ministry as the flexible progressive system of street-traffic control. The underlying principle of the latter system is that traffic proceeding at a definite speed along a main thoroughfare crossed by a series of minor cross roads will always arrive at successive intersections when the "green" or "GO" signal is displayed, and there will thus be a minimum interruption in the steady flow of main-road traffic. The controller, fig. 1, is suitable for operation from either d.c. or a.c. electricity supply at standard voltages. The latter differs from the former only in the conversion from alternating to direct current by means of Westinghouse metal rectifiers. The lamp switching group comprises four "Strowger" relays, operating four mercury-tube contactors. The relays are arranged to operate and release in cyclic order by the stepping of a "Strowger" five-level rotary line-switch.

An Automatic Curtain Controller.

Among a range of electric automatic curtain controllers developed by the FALKSLEY CO., Albert Chambers, Derby Road,

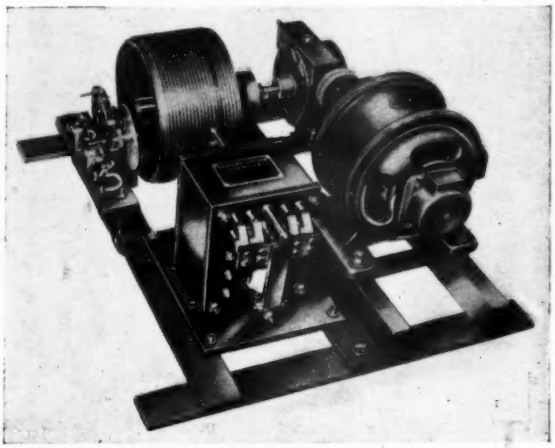


Fig. 2.—"Falksley" Type C Curtain Controller and Light Dimmer.

Nottingham, is the type C, fig. 2, which is designed to meet the demand for an efficient electric curtain control to which may be added, as a special feature, a light dimmer working automatically in conjunction with it, and so combining the two machines in one unit. An electric motor of ample power is provided, coupled to a driving drum of the required dimensions by means of worm gear suited to the size of curtain The curtain is connected to the driving drum by steel-wire rope. The light dimmer is so arranged that, as soon as the curtain starts to open, the lights in the auditorium and/or stage are gradually and evenly dimmed until the curtain is full open, when the lights go out. On the curtain being closed the lights are brought back evenly and gradually. The motor is started by means of a switch, and is stopped by automatic switches actuated by the driving drum, whereby a positive stop is ensured. The whole apparatus, which is mounted on a heavy iron framework, is claimed to be compact, electrically and mechanically sound, and foolproof. The control switch may be fixed in any desired position, so that both curtains and lights may be controlled from one or more points. An outstanding feature of this controller is that the curtain can be opened or closed to any point without having to complete its full journey.

Built-on Geared Motors.

A range of "built-on" geared motor units, utilising ventilated as well as totally-enclosed machines, has been developed

Fig. 3.—"Built-on" Motor Unit by Siemens-Schuckert.

by SIEMENS-SCHUCKERT (GREAT BRITAIN), LTD., 30-34, New Bridge Street, E.C.4. The range covers from fractional-h.p. to 250-h.p. motors, while special motors up to 1,000 h.p. em-

bodying this type of "built-on" gearing have also been developed. In all cases harmonious designs have been arrived at, the motor and gearing appearing as one indivisible unit. An outstanding feature of the unit is its compactness, which is reflected in valuable economy of space. Compared with separately mounted gears, erection is facilitated to a considerable extent, the necessity for alignment of the gearing at both ends being dispensed with, and the foundations being smaller and less complicated. The motor-unit shown in fig. 3 is worthy of note; cooling is effected by means of an external fan, fitted outside the end shield and suitably protected by a cover, and the frame of the motor is provided with horizontal ribs. The air is blown by the fan in a horizontal direction along the motor frame, thus coming into intimate contact with the ribbed surface of the stator along its entire length. There being no necessity for an outer casing, all danger of overheating as the result of clogging of the air passages of a double-casing is eliminated. The cooling is claimed to be such that the dimensions of this type of totally-enclosed motor are a little greater than those of an ordinary ventilated motor of equal output. The starter is mounted directly on the motor. It is oil-immersed, has liberally dimensioned drum-type contacts, and embodies, in addition to the rotor starter, a triple-pole main switch. No-volt and overload releases, as well as an ammeter, are provided, while the operating hand wheel is mechanically coupled to the brush-lifting device of the motor. Long cable connections between the starter and motor are avoided, and the arrangement is very simple. This method of building the starter directly on the motor can be also used with normal high-speed open and totally-enclosed motors. The complete unit, comprising high-speed totally-enclosed motor, reduction gearing, and starter, has found wide application for the heaviest duties in chemical factories, cement works, rolling mills, textile factories, and in industries which are, even to-day, to some extent reluctant to employ individual drives.

The Hydro-electric Power Commission of Ontario.

Extracts from the Annual Report for the Year 1929.

THE twenty-second annual report of the Hydro-Electric Power Commission of the Province of Ontario, covering the year ended October 31st, 1929, has recently come to hand. It is a volume of over 450 pages and deals exhaustively with the whole of the Commission's activities; financial statements are also given relating to the municipal electrical utilities operating in conjunction with the various systems of the Commission and supplying electrical service to the Province.

Power for the several electrical systems was obtained from thirty-two hydro-electric plants operated by the Commission supplemented by power purchased from other sources. During the year the constructional activities of the Commission were featured by a number of outstanding developments and expansions. In the Niagara system the tenth generating unit was ordered for the Queenston generating station, and the final extension to the power house to accommodate this unit is well under way. The westerly half of the second circuit of the 220,000-V transmission line conveying power from the Gatineau River plants has been completed and placed in operation. A two-circuit 110,000-V steel-tower line was constructed and placed in service from a point near Queenston to St. Thomas. This will reinforce the power supply and improve voltage conditions in the western section of the Niagara system. With regard to the Georgian Bay system, the generating station at Tretheway Falls was placed in operation and two small generating stations at Bala in the district of Muskoka were purchased and improved. Additions were made to the high-pressure network of the newly-formed Eastern Ontario system, which is an amalgamation of the former Central Ontario and Trent, St. Lawrence, and Rideau systems. The network serves the dual purpose of linking together these three former systems and of connecting the several divisions of the present system with new large sources of power received at Ottawa over the transmission lines from the Gatineau power plant. The new generating station at Elliott Chute was placed in operation, and good progress was made on the new 54,000-h.p. development at Alexander on the Nipigon River. A development at Ear Falls on the English river will serve the mining district of Red Lake and have an ultimate capacity of 30,000 h.p. Investigations are in progress on a number of other power sites. The first of these is at Chats Falls on the Ottawa river, where a possible 200,000 h.p. can be developed. Preparations are also being made for the development of the power at Ragged Rapids on the Muskoka River.

The total investment of the Commission in power undertakings and hydro-electric railways is $222,082,637 and the investment of the municipalities in distributing systems and other assets is $92,154,280, making in power and hydro-electric railways a total investment of $314,236,917. The total revenue derived from the operation of this capital investment during the year aggregated $39,969,624.

The revenue obtained from the consumers was more than sufficient to meet the full cost of generating and transmitting the electrical energy, as well as to provide for all operating expenses and fixed charges of the municipal utility equipments. The Commission collected from the municipal utilities and other customers for power supplied, a total sum of $26,983,584. This sum was appropriated to meet all the necessary fixed charges, and to provide for the expenses of operation and administration. After meeting all charges there was a net surplus of $1,575,225.

During the past few years very substantial progress has been made in rural electrification. Practically all rural electrical service is now given through rural power districts, which are operated directly by the Commission. There is now more than $9,300,000 invested in the rural power district systems established by the Commission. About 4,835 miles of transmission lines have been constructed to date of which 1,044 miles were constructed during the past year. There are now more than 37,000 consumers supplied in the rural power districts. The total reserves of the Commission and the municipal electrical utilities for sinking fund, renewals, contingencies, and insurance purposes amounted to $89,940,323.

An outstanding feature of the year's operation was the large increase in load on most of the systems. The peak loads of all systems showed an increase over last year (excluding export power) amounting to 16 per cent. The total power generated was 4,340,315,196 kWh, of which the Queenston plant (Niagara) provided 2,827,620,000 kWh and the "Ontario Power" 772,716,700 kWh. In addition 652,621,833 kWh was purchased, mostly from the Gatineau Power Co., giving a grand total of 4,992,937,029 kWh, as compared with 4,341,498,634 kWh in 1927-28. The total output increased by 799,000,000 kWh, or 23 per cent. A dry summer season affected the water supply and generating capacity on all except the Niagara, St. Lawrence, and Ottawa systems. The water supply was particularly deficient on the Georgian Bay system, where special arrangements had to be made for the purchase of power from outside sources.

The Approvals Laboratory received 475 applications for approval reports, an increase of 45 per cent. over the preceding year. Of these 26 per cent. referred to motor-operated appliances, 23 per cent. to heating appliances, 15 per cent. to radio and sound-reproducing appliances, 15 per cent. to lighting devices, and the balance to wiring devices, sockets, switches, &c. In addition 62 special applications were received for temporary approval of various devices, and 184 applications for listing of equipment approved by the Underwriters' Laboratories.

The Electrical Inspection Division issued 96,701 permits and made 185,582 inspections. Nine fires were reported to have been caused by defective wiring or equipment, and thirty persons and companies were prosecuted during the year for various infractions of the rules and regulations. Three persons were killed through coming into contact with live equipment, two of these deaths being the result of carelessness.

The Canadian Electrical Code, the first edition of which was published in 1927, and adopted by the Commission in 1928, has proved eminently satisfactory. A second edition has been prepared, embodying changes made necessary by the advances in the art and by the experience of inspectors throughout the Dominion since the first edition was published. It is expected that the new edition will be adopted during the current year.

The report proper is concluded with a review of the operation of the Commission's electric railways. The remainder of the volume is devoted to statistical information relating to the operation of each municipal utility. A complete index is appended and the volume is well illustrated. There is a large scale map of the area in which the Commission operates.

High-power Switching.

A review of modern British practice in the design of Switchgear having capacities of 1,000,000 kVA and over.

By R. W. GREGORY and F. C. WINFIELD.

(Abstract of a paper presented at the Second World Power Conference.)

THE grid influences considerably the design and layout of high-power switchgear. The capacity of individual 132-kV feeders on the grid is 50,000 kVA or more, and the future economic generating unit will be not less than this size. Increase in the size of the generating unit and connection to the grid imply larger generating stations running at high load factors which, in turn, involve: (*a*) an increase in the breaking duty on switchgear, (*b*) a tendency to increase the voltage of switching in order to restrict the current to reasonable limits, (*c*) an increase in the cost of the switch unit to meet the higher breaking duty and the higher loading. The combined effect of these will be that, on high-power switchgear, individual switch units will be used only for handling larger blocks of power, say, 20,000 kVA and more, and the voltage of high-power switchgear tends to be 33 kV, 66 kV, or 132 kV. Where lower voltages are used there is already a tendency to group smaller-capacity circuits under the control of one main switch unit. The rated breaking capacity of switchgear at present installed in the larger generating stations in the country does not exceed 1,500,000 kVA. Bus-bar sectioning with reactance is used where necessary to keep the breaking duty down to this figure, and switchgear so designed has given satisfactory operating service. The leading British manufacturers are able to supply oil circuit breakers of rated breaking capacities up to 2,500,000 kVA, which are usually confined to the higher voltages.

Mechanical Features.

For a given design of oil circuit breaker at a given voltage the process of breaking a fault produces gas in quantities more or less proportional to the power interrupted. This gas is formed with explosion rapidity, and the general practice is to build switch tanks as steel cylinders with dished ends. Most manufacturers build their tanks of welded steel plates; some press from solid steel, and one manufacturer uses a very-high-quality cast-steel.

Circuit-breaker tank top plates, when removable, are either steel castings or of fabricated steel plate, at least equal in strength to the rest of the container. It is not uncommon to design top plates of greater strength than the tank itself, as, in addition to having to withstand the static gas pressure, they have also to withstand the impact of the oil thrown up when the arc is formed at the switch contacts.

British designs show that for the same breaking capacity an increase in the volume of oil in the circuit-breaker tank permits a decrease in the strength of the tank. Consequently, circuit breakers for 66 kV and 132 kV, working with a rated breaking capacity of 1,500,000 kVA, are designed to withstand a sustained hydraulic test pressure of 150 to 200 lb. per sq. in., whereas with circuit breakers of 33 kV and under, of the same breaking capacity, the sustained hydraulic test pressures vary from 350 to 800 lb. per sq. in.

For circuit breakers of 1,000,000 kVA and over it is invariable practice to use one oil tank per phase; this is essential when the switch operates at high voltage.

For heavy-current rating, *i.e.*, about 1,000 A and over at 50 cycles, special arrangements are made to reduce magnetic heating in the circuit-breaker top plates. The various methods of construction used are (*a*) non-magnetic steel castings, (*b*) gun-metal castings, (*c*) silicon-aluminium castings, (*d*) steel castings with gunmetal or other non-magnetic insets to break the magnetic circuit.

The general practice on pressures below 132 kV is to design circuit breakers so that the tank can be separated from the top plate which supports the current-carrying and circuit-breaking parts. The joint between the tank and the top plate must be completely gas tight or of such dimensions that hot gas ejected from the tank through the joint is cooled down below the temperature at which it ignites spontaneously. Metal to metal joints are advantageous, but some form of joint packing is considered necessary on outdoor circuit breakers in order to keep out moisture.

On certain 132-kV circuit breakers in service in Great Britain, in which two breaks per phase only are used, the top plate is welded permanently to the tank, and a manhole is provided for access to the circuit-breaker contacts for maintenance purposes. This method of construction is only possible when the tanks are large enough to allow room for a manhole in the cover (or side), and in general it cannot be used on circuit breakers for lower pressures than 132 kV. The welding of the top plate to the tank is not general practice. There is a preference for the removable top plate, as this arrangement not only provides for easier maintenance, but assists in the accurate assembly and setting up of the circuit breaker and its mechanism. On multi-break circuit breakers for 132 kV the invariable practice is to provide removable top plates in addition to the manholes. The circuit-breaker operating mechanism usually adopted is of the parallel-link type. One manufacturer uses the rack and pinion type. D.c. solenoid operation is general, although certain special installations use motor-operated mechanism either on a.c. or d.c.

Electrical Features.

The circuit breaker design usually adopted in Great Britain for high rupturing duty includes six, four, or two breaks per phase, the last often with explosion pots. There is a tendency towards the use of a high speed of break which is produced by heavy throw-off springs and light moving parts. The speeds of the cross-arms carrying the contacts vary from about 5 to 10 ft. per second, the higher cross-arm speeds being used on breakers with two breaks per phase. Oil dash pots are generally used to reduce the shock at the end of the stroke of the cross-arm. It is usual to provide a sufficient air space between the oil and the top plate to prevent the mechanical pressure rising to an unsafe limit, coupled with means of venting the gases without allowing material loss of oil. Arcing contacts are designed with sufficient mass of metal to prevent serious burning in fault conditions, and the solenoid operating gear is made amply strong enough to close the breaker against the forces produced by short-circuit.

The insulation inside the circuit breaker is usually bakelised paper and porcelain. The chief troubles experienced in the past with bakelised-paper insulation under high voltage stress in oil have been: (*a*) air spaces between laminæ due to imperfect manufacture, (*b*) surface tracking chiefly on horizontally disposed insulators, due to accumulation of carbon and to the surface of the insulators not being entirely non-hygroscopic, and (*c*) ingress of moisture through the laminæ exposed at the ends of the insulators.

To overcome these troubles, (1) special attention is paid to the manufacture and testing of the insulator to ensure that it has a low dielectric loss and is free from air spaces, and (2) the surface and ends of the insulators are covered with a non-hygroscopic varnish (one manufacturer provides moulded end caps to seal off the exposed laminæ completely), and, in general, the use in a horizontal position of paper insulators under voltage stress when the circuit breaker is closed is avoided in the design of the circuit breaker.

Bushing insulators for high voltages are either of the condenser type in porcelain containers with oil or compound filling, or of the oil-filled type with grading shields. Operating rods are generally bakelised-paper tubes, but for pressures up to 33 kV some makers use specially prepared and impregnated wood. A failure of insulation inside a circuit breaker is extremely serious, as usually the circuit breaker is a part of the bus-bar system, and cannot be cut out by the protective gear of the circuit it controls. A small leak to earth may be more dangerous than a heavy fault, as it may be unnoticed by the operators, and, since the insulation is usually immersed in oil, this may result in an oil fire or an explosion. In order to limit the damage from rapid and continuous vaporising of the oil, the breaker is so ventilated that all gases are expelled well away from the switchgear itself, and any oil ejected is thrown to a position where it is not dangerous. In certain designs of circuit breaker in which the normal vent is provided with baffles which may interfere with the free flow of gas, pressure-relief diaphragms are fitted which fracture at a pressure somewhere between the calculated working pressure and the yield point of the circuit-breaker tank structure. Other manufacturers provide spring-closed relief valves for the same duty. To reduce the risk of an oil fire, it is common practice to run an outlet pipe from the relief diaphragm or relief valve to a gravel pit or drain.

Metal-clad Switchgear.

For pressures up to and including 33 kV, metal-clad switchgear is established practice, the use of cellular-type or outdoor open-type gear now being rare for large stations at these pressures.

Metal-clad gear in which the circuit breakers were designed for a breaking duty of 1,500,000 kVA was first used in Great Britain in 1917. At the present time, practically all the larger manufacturers of switchgear have developed metal-clad switchgear designed for high-power duty. The voltage at which metal-clad gear is operated has been limited by the development of underground cables, as metal-clad gear is the logical termination of lead-covered paper-insulated cables. Metal-clad gear (of the draw-out type) is now being manufactured for 66 kV, and it is quite probable that as 132-kV cables become more generally used, metal-clad gear for this pressure will be used in congested areas where space is costly and where atmospheric conditions make it difficult to maintain exposed insulation. On metal-clad gear, all live connections and all insulation are enclosed in earthed metal. For purposes of isolation and maintenance, the circuit breakers are usually made to withdraw from the bus-bars and circuit connections. The great advantage of metal-clad gear which is particularly applicable to British conditions is its compactness, which not only saves space, but allows for easy and efficient interlocking.

There are four methods adopted in British designs of metal-clad gear for the isolation of the circuit breaker: (1) horizontal draw-out, which is common for switchgear of lower breaking capacity—this is used by several manufacturers for switchgear with a breaking duty of 1,000,000 kVA; (2) vertical draw-out—this is becoming the most usual method of isolation; (3) non-draw-out circuit breakers with oil-immersed isolators; (4) a combination of 2 and 3, *i.e.*, vertical draw-out with oil-immersed isolators.

The bus-bars on metal-clad switchgear are enclosed in metal containers. The copper conductors are usually wrapped with fibrous insulation and submerged in either compound or oil. Compound has been mainly used for this purpose for a number of years, but there is now a tendency towards the use of oil, particularly at the higher voltages. Oil has the advantage that it is a better transmitter of heat than compound, and where bus-bars carry heavy currents it allows an appreciable reduction in the area of the conductor. It is usual to keep the oil under a small pressure by means of conservator tanks as used on transformers.

Cellular-type Switchgear.

The term "cellular-type switchgear" is applied to switchgear in which the main connections and bus-bars are bare conductors mounted on porcelain insulators. The whole gear is enclosed in brickwork or concrete cells, designed to separate adjacent switch units and to reduce to a minimum the possibilities of, and dangers from, short-circuits, and also at the same time to prevent access to the live conductors, either from human beings or vermin. The latest British example of this type of switchgear is that installed in the new Hams Hall station of the City of Birmingham and the Deptford West station of the London Power Company.

The general principles in cellular-type switchgear design are as follows:—(1) the circuit breaker is kept apart from the rest of the gear, preferably in a separate room; (2) the bus-bars and the bus-bar isolators are housed in a chamber separate from the rest of the gear and from other bus-bars; (3) individual circuits are well separated from neighbouring circuits and the whole gear is so partitioned that a failure on one circuit does not affect neighbouring circuits or the whole supply.

In all high-power switchgear, the circuit breaker is always a potential source of danger. Good modern practice in cellular-type gear is to keep this well away from the rest of the gear. The arrangements preferred by the authors are those in which the circuit breaker itself is placed outside or effectively outside the building containing the bus-bar isolating devices and circuits.

Outdoor Gear.

On account of the space required and the cost of buildings, outdoor switchgear is being used for all the 132-kV switching stations on the British grid. It has been used to a certain extent on the 66,000-V switchgear and to a lesser extent on 33,000-V switchgear.

Open-type outdoor switchgear has the advantage that above certain voltages there is a saving in cost over other types. It is, however, exposed to danger from lightning and short-circuits from birds, straw, &c. It is more accessible to malicious damage than indoor gear. Maintenance is difficult in bad weather, and the cost of maintenance is relatively high; also, the risks to the maintenance staff are greater than with indoor gear. In dirty districts it is necessary to maintain the insulation by frequent cleaning of insulators. Normally, the ground space occupied is high. The most serious objection is probably the difficulty of maintaining insulation in dirty districts. This is a problem which has to be faced, not only on outdoor switchgear, but on overhead lines. There is a very definite need for insulators of such shape or design that will eliminate periodical cleaning. In England the experience with standard cap and pin suspension-type insulators has been that the dirt accumulates on the underside of the insulator. The upper side is kept clean by the rain, but the underside is not washed. It is, therefore, considered possible that progress in the design of insulators for dirty conditions in Great Britain, at any rate, may be made by increasing the length of surface exposed to rain.

There is a definite trend in the development of metal-clad gear towards making it suitable for outdoor work. The metal-clad gear at the State Line Power Station, Chicago, which has a rated breaking capacity of 2,000,000 kVA, is erected entirely out of doors without cover, and the development of 66-kV metal-clad gear in Great Britain is on similar lines.

Metal-clad gear is inherently more suited to outdoor working than open-type gear, as its insulation is not exposed. Owing to its general compactness, the cost of a building enclosure is not great, and may be offset by increased reliability. It is possible that the ultimate designs of high-power metal-clad switchgear will be of the indoor type, more especially if the increasing knowledge of circuit-breaker design results in a greater certainty of consistent and correct performance and the consequent reduction of risks from circuit-breaker failures.

The various methods of bus-bar selection and isolation are: (*a*) removable and interchangeable plug-type isolators or, alternatively, plug-type isolators with the plugs arranged to rotate on a seating on the circuit breaker to give two positions; (*b*) oil-immersed selector isolators; (*c*) transferable circuit breakers with fixed plug-type isolators; (*d*) duplicate circuit breakers—one connected to each bus-bar; (*e*) air-break selector switches.

Methods (*a*), (*b*), and (*c*) apply to metal-clad gear only, and method (*e*) to cellular-type and outdoor-type gear only.

The authors feel that two circuit breakers housed in different chambers are justified for the control of the larger generators now in existence.

Each generator unit forms such a large proportion of the total station output that every effort must be made to increase the running load factor. The use of a second circuit breaker permits normal switchgear maintenance, or even complete repair of a circuit breaker, without interfering with generator operation. It is not always necessary to use two circuit breakers on each individual outgoing feeder; all important feeders on a large system are effectively duplicated, either by parallel feeders or ring-main interconnectors.

Layout of Switchgear.

In British practice it is generally assumed that, no matter how well designed or constructed, a circuit breaker constitutes a risk, since some small fault, due to uncertain materials, bad maintenance, or other causes may result in failure.

The principles adopted in laying out cellular-type gear, which are in the main universally accepted, are:—(1) to design individual units and equipments so that the risks of breakdown are reduced to a minimum; (2) to separate equipments by barriers and partitions so that the failure of one switch unit does not damage its neighbour; (3) to arrange switch units and system connections so that one whole group can be put out of commission without seriously affecting service; (4) to provide means of fighting fire, draining, handling oil, &c.; (5) to provide for easy and safe maintenance; (6) where necessary to section the switchgear with reactors to keep the breaking duty inside the capacity of the circuit breakers, and to maintain the voltage of the system in fault conditions; (7) to eliminate, as far as possible, all external inflammable materials.

In outdoor open-type gear the same general principles apply as for cellular gear, but wide spacing is substituted for barriers and partitions. The high cost of 132-kV switchgear makes it desirable to reduce to a minimum the number of circuit-breaker equipments employed at a switching station. On the Grid, therefore, where there are only two feeders, the "three switch" arrangement is adopted. This is not designed for extension and possesses the feature of low height and ease of maintenance. Where there are more than two feeders double bus-bar arrangements are employed. The design of the 132-kV switchgear on the British grid is discussed fully in the paper given by Messrs. Johnstone-Wright and Marshall before the British Institution of Electrical Engineers (I.E.E. Proceedings, 1929).

The principles governing the layout of metal-clad gear do not differ from those applying to cellular-type gear, except that since metal-clad gear has been shown in practice to possess a considerable degree of fire resistance, to be effectively phase isolated, and to offer a much reduced risk of operation, a certain amount of latitude is permissible in applying the principles.

Circuit-breaker design throughout the world is still far from finality, and insufficient experience is yet available of circuit-breaker operation when interrupting faults of 1,000,000 kVA and upwards. The industry is on the verge of big developments in oil circuit-breaker design; the American Deion breaker and the British quenched-arc breaker are examples which show the trend of modern attack on the problem, and it is perhaps not too much to expect that before long circuit breaking will no longer be "explosive." If these expectations are realised, then switchgear layout will, no doubt, be considerably more compact than at present, and, for this reason, the type of switchgear will tend more than ever to be metal-clad. If the "non-explosive" circuit breaker does not materialise, then, as the breaking requirements increase, switchgear will tend to be more spread out with wide spaces or substantial barriers between circuit breakers. A possible development is metal-clad gear placed out of doors with the switch units widely spaced or, alternatively, metal-clad gear with the switch units enclosed in strong fireproof cubicles and with the circuit breakers themselves well separated from the rest of the gear.

Industrial Power Factor.

Two instances of improvement by the installation of "Kosfi-Leading" motors of the English Electric Co., Ltd.

SINCE the introduction of the compensated induction motor, "Kosfi-Leading," by the English Electric Co., Ltd. (Electrical Review, March 9th, 1928, p. 442), the company's engineers have studied the power-factor question in a large number of factories, mostly of small and medium size, and where they have recommended the installation of

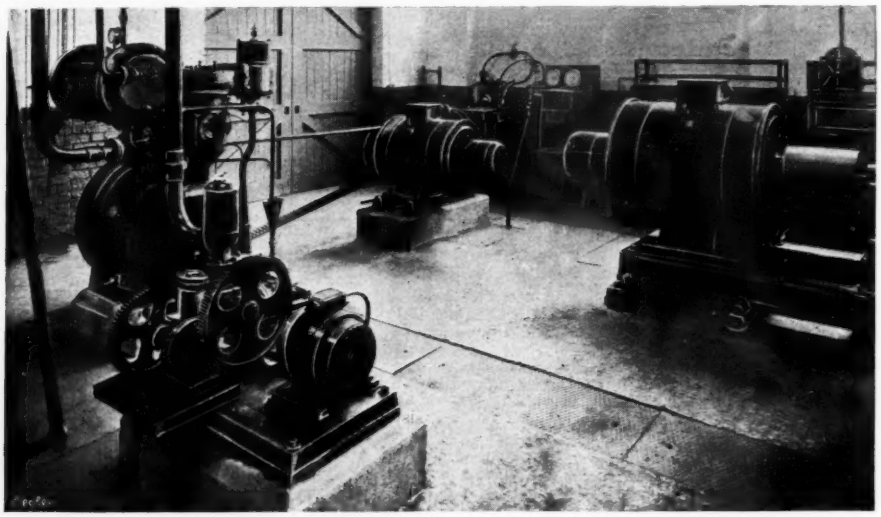


Fig. 1.—"Kosfi" Motors, 120 h.p. and 60 h.p., which Improved Works p.f. from 0.75 to 0.92.

"Kosfi" motors as justifiable on economic grounds highly satisfactory results are claimed to have been obtained. The "Kosfi-Leading" motor is not a machine which operates normally as a synchronous motor, as in the case of the synchronous-induction motor, but it is a compensated induction motor which is not liable to drop its load until the maximum stalling torque is reached. The functions of the stator and rotor of the ordinary induction motor are reversed, in that the rotor becomes the primary, to which the power is supplied, and the stator becomes the secondary winding. The rotor, in addition to having the normal winding of the wound-rotor machine, carries a winding connected to a commutator having brushes spaced round its periphery. To these brushes the stator winding is connected through suitable starting resistances. The machine can be designed to give any power factor from unity to 0.5 leading, and its actual value for any given machine can be varied by simply rocking the commutator brush-gear. The efficiency curve is high and flat and somewhat better, it is claimed, than that for a standard slip-ring induction motor of similar rating and speed.

The following interesting particulars relate to two "Kosfi-Leading" motor installations. Fig. 1 shows two "Kosfi" motors installed in an engineering works which had an average load of 450 kVA and a power factor of 0.7 to 0.75 lagging. A 120-b.h.p. motor with a power factor of 0.55 leading replaces a gas engine, and a 60-b.h.p. motor with a power factor of 0.9 leading drives an air compressor. The power factor of the system was raised to 0.92 lagging, resulting in a saving of nearly £200 per annum.

The second case is that of the steel works of Messrs. F. H. Lloyd & Co., Ltd., near Wednesbury, with a load of 400 kVA and a power factor (previously) of 0.65 lagging. New compressors were being installed with two 75-b.h.p. "Kosfi-Leading" motors with a power factor of 0.7 leading to drive them. One of the motors, fig. 2, was, however, employed to drive a d.c. generator used for lighting and welding purposes, as this was found a better proposition. As a result the power factor of the system was increased to 0.93 lagging, thereby effecting a saving of approximately £20 per month on the power bill.

The Buenos Aires Subways.

Spanish Company's Scheme Approved.

(From our Buenos Aires Correspondent.)

FOR the first time, a proposal for an extended system of underground electric railways has been approved by a majority of the Municipality of Buenos Aires—that recently put forward by the Compañia Anonima de Projectos y Construcciones de Madrid.

The Anglo-Argentine Tramways Company, which at present holds the concession, has always maintained that the ten cent fare (2d.) for direct journeys below ground and fifteen cents (3d.) for combination tickets with surface trams, are rates which are too low to provide an adequate return on the capital involved for underground electric railways here. These rates are in force on the only tube at present working in the city, the A.A.T. Co.'s "Subterraneo" which extends from Government House to Caballito (Primera Junta), a twenty minutes' run constructed below the main west thoroughfare, Calle Rivadavia.

Schemes put forward by this company for extended railways have been based on their being allowed to collect twelve cents as a minimum fare, but the Municipality has for over ten years voted against any increase in the original ten cents granted when the Subterraneo was built, and which is the fare for surface cars.

The Ampthill Syndicate, generally understood here to have been backed by the English Electric Co., put forward a scheme three years ago, accepting the ten cent fare, but the Municipality vetoed the scheme on the pretext of "insufficient financial backing."

The Spanish concern, the "C.A.P.Y.C.," in collaboration with the Compañia Gallega de Construcciones has the following works under construction, and the soundness of the company is based on these works in official circles. Works in Spain: State railway from Baeza to Utiel (190,000,000 pesetas), railway from Pontevedra to Marin (5,000,000 pesetas), first part of Pantano del Tranco (500,000 pesetas), main roads in Cataluña (17,000,000 pesetas), institutions, colleges, hospitals in Madrid, Valencia, Malaga, &c. (11,000,000 pesetas).

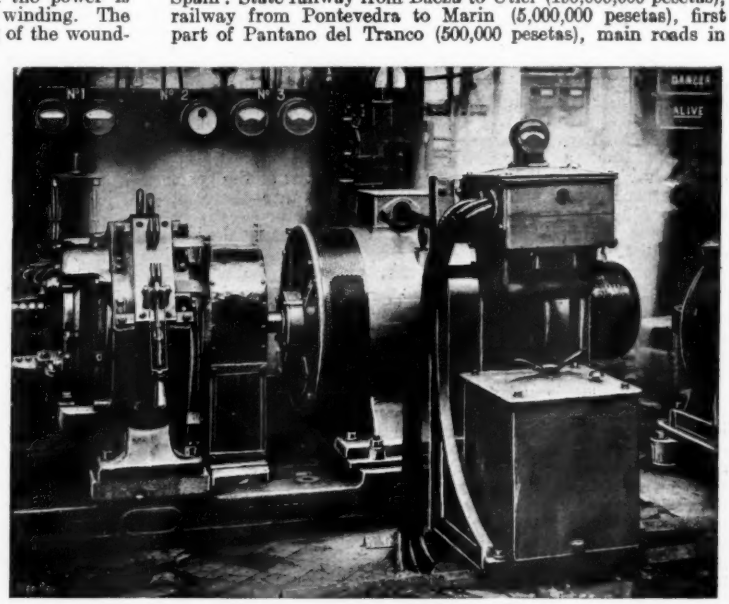


Fig. 2.—One of two "Kosfi" Motors which Improved p.f. by 43 Per Cent.

This company agrees to deposit the sum of 2,000,000 pesos (£166,000 approx.) as guarantee, this sum being forfeit in the

event of the non-fulfilment of the contract. The Intendente (Lord Mayor) has power to throw out the scheme, irrespective of the Municipality vote, but should he decide to support the measure the Anglo-Argentine Tramways Company's concession would constitute a difficulty, the solution of which would be observed with interest.*

There is another "tube" nearing completion in the city of Buenos Aires, that of the La Croze Tramways Company. This runs practically parallel with the Anglo's Subterraneo, and does not seriously compete with it. This company's lines operate outside the city, and the construction of the new underground line will have for effect the elimination of its heavy stock from the city streets and will act as a feeding line between the city and the company's terminus, La Croze, which is on the outskirts of the city.

* A later cabled report announces that the Spanish company's scheme has been approved by the Deliberative Council, although the Intendente had pronounced against it.—EDS. ELEC. REV.

Correspondence.

***Correspondents should forward their communications as early as possible.** No letter can be published unless we have the writer's name and address in our possession.*

Electricity v. Gas for Heating.

Your correspondent, writing under the above heading in your issue of the 22nd inst., gives a simple formula by which to determine the cost per kWh of electricity which will be equivalent to the cost of gas per therm. This statement seems very misleading, as no mention is made of the relative efficiencies of the two types of heating apparatus.

In the case of electric furnaces, for instance, it is quite usual to maintain an efficiency of 80 per cent. or 90 per cent., whereas, in gas-heated furnaces, owing to flue, draught, and other factors, the average efficiency is far below this figure. Certainly, when the actual calorific value of the two units is considered alone, the gas costs appear more favourable, but the position is reversed when viewed in conjunction with the relative efficiencies, which factor must be considered if a true comparison is to be made.

It is interesting to note in connection with efficiencies that with an electric furnace fitted with a magnetic detector, it is possible to harden a certain output of steel in a smaller furnace than is required when hardening by temperature alone. This obviously further reduces the heat losses and increases the efficiency.

Wild-Barfield Electric Furnaces, Ltd.,
J. E. ORAM.

London, N.7. *August 26th*, 1930.

Gas Enterprise.

I should like to put on record the enterprise of the gas company in my district. Since we went into our all-electric house in January last we have had no fewer than three calls from the gas company to read the gas meter. It was not until after the third call that the representative was fully convinced that there was no gas supply to the house.

W. E. Warrilow.

Oxhey, Herts., *August 26th*, 1930.

Electric Organs.

Your recent article and also your correspondent's letter in to-day's ELECTRICAL REVIEW are interesting to us.

He states that Messrs. Henley's made electro-magnets for Mr. Robert Hope-Jones about 35 years ago.

We can go further back than this, by stating that we made some of the first electro-magnets for Mr. Robert Hope-Jones over 45 years ago.

The writer had the pleasure of winding some of the coils on a treadle lathe which is in our possession at the present time.

For **W. Lilley & Co.,**
E. L. LILEY, A.M.I.E.E.

Liverpool, *August 29th*, 1930.

It may be of further interest to know that over 40 years ago I, in conjunction with my then partners, Messrs. Appleton, Burby & Williamson, supplied Mr. Robert Hope-Jones with large numbers of these electro-magnets, and if my recollection be correct the price was somewhat of the same order as that named by Mr. Fuller.

Edward L. Joseph.

London, S.W.1, *September 1st*, 1930.

An Advertising Matter.

We cannot allow Mr. Mallet's letter in your issue of August 29th to pass without a reply.

There are two classes of small single-phase repulsion motors:

(*a*) Repulsion induction motor with two distinct windings on the armature, both of which are active when the machine gets up to speed.

(*b*) Repulsion *start* induction motor, with one winding on the armature only. When the machine attains a pre-determined speed the commutator is short-circuited and the brushes may, or may not, be lifted; it then functions as an induction motor, but has the advantage of a repulsion start. As the name implies it is a "repulsion-start induction motor." This machine is in every way superior to (*a*).

On Friday, August 22nd, we were advised by the ELECTRICAL REVIEW that Mr. Mallet had taken exception to our advertisement. We immediately wrote to his firm informing them that we were well aware that they manufactured (*a*), but that it was news to us that they were manufacturing (*b*), and that we should be pleased to receive their further observations, to which letter we have not received a reply. We have never seen any literature or advertisement wherein they claim to supply this class of motor.

Class (*a*) has been manufactured by us since May, 1927, and it is now made by at least half-a-dozen other firms in this country, but until Mr. Mallet or some other British firm gives us proof that they are selling class (*b*), manufactured in this country, we shall continue to advertise in a similar strain, as and when we think fit.

Higgs Motors,
WALTER HIGGS.

Birmingham, *August 29th*, 1930.

We notice in your issue of August 29th a letter from the Normand Electrical Co., Ltd., relating to an advertisement which appeared in your issue of the 15th inst. in which a firm advertised that it was the only firm in Britain making repulsion start induction motors, and we wish to associate ourselves with the letter in your issue of August 29th, as, of course, there are a number of British firms who have been producing this class of machine for some time.

We notice, however, that the advertisement is repeated again in the current issue, and we shall be glad to know whether you propose continuing the acceptance of advertisements with such erroneous statements.

We should have thought that a paper of your standing would have insisted on a matter like this being corrected before publication, as this is bound to influence prospective and current advertisers, particularly as it is an indirect reflection on the other British small motor manufacturers who are producing these machines.

M. W. Woods, Ltd.,
M. GEOFFREY WOODS, *director*.

London, W.C.2. *August 30th*, 1930.

[There is obviously difference of opinion between the two advertisers as to what constitutes a repulsion start motor. Is it suggested that it is legitimately within the province of the editors to settle advertisers' differences? The subject seems to be one of definition and of easily ascertainable actual facts. Perhaps the parties could find a ready solution by availing themselves of the services of a technical referee acceptable to both sides.—EDS. ELEC. REV.]

Young Engineers for Abroad. What Prospects?

One learns from the daily Press and elsewhere of the urgent need for young men in our Colonies, but no doubt thousands of young trained engineers who like myself are willing, even anxious, to go abroad find it extremely difficult to do so.

My practical training has been on the manufacturing side of electrical engineering (covering about 15 years, including apprenticeship, University training, and practical experience). Since, however, the Colonies appear to buy all their machinery, with the exception of a little in Australia and Canada, and being reluctant to throw away my training and experience to take up, say, farming, I feel compelled, much against my wish, to stay here where the machines are made.

Possibiy some of your readers who know the Colonies may be able to offer some advice to those who are on the manufacturing side, with little or no experience of generation and transmission.

For myself I am particularly interested in New Zealand or South Africa.

Eee Bee.

August 31st, 1930.

[We are frequently asked questions of this kind. Such information as is available is readily placed at our readers' disposal. Most electrical and engineering openings are advertised in our own pages and in the engineering Press, and general information regarding the outlook is obtainable at the various Empire Headquarters in London. Some non-electrical associations have central home and Colonial offices where very helpful work is rendered to those willing to go abroad—cannot one of the technical engineering associations find an opportunity of arranging advisory service in some such way? We shall welcome helpful suggestions from our readers. We have known many electrical engineers who, in periods of depression here, have gone overseas and made good as fruit growers, poultry farmers, &c., or have changed over at home to become licensed victuallers or clergymen, and been well satisfied with the change until new electrical opportunities have opened up. —EDS. ELEC. REV.]

Reviews.

Television for All. By Chas. G. Philp. Pp. 82; figs. 8. London: Percival Marshall & Co., Ltd. Price 1s. net.

This little book is clearly intended to serve the sole purpose of giving an elementary description of television principles, and does no more. As such it will be of value to those interested in this fascinating subject, and the price will bring it within the reach of all.

The possibilities of television are discussed (Chap. I), together with the practical scope in prospect and an historical outline of progress to the beginning of this year.

Broad principles are briefly described (Chap. II), some account given of methods of scanning, followed by a general reference to selenium, while photo-electric cells are explained in fair detail, and also neon lamps. The description given of the Kerr cell appears to be laboured and is difficult to follow, while that of the cathode ray is vague and liable to mislead.

The vital need of synchronism is made clear (Chap. III), and details are given of the Baird system, with an attempt to explain exactly how this is made to function.

A general summary is given (Chap. IV), an account of the application of infra-red rays and their possible use (Chap. V), continuing with an outline of the progress made towards practical television in colour (Chap. VI), while stereoscopic effects are mentioned (Chap. VII).

The views of some critics are refuted with greater severity than proof in Chapter VIII, and the construction of television receivers by amateurs is optimistically outlined in Chapter IX, and afterwards a precise account is given of the actual results at present obtainable with the Baird system.

The illustrations and diagrams are moderately clear, but give little detail, while the explanations and descriptions could well be more lucidly expressed, and few will agree with the author in leading readers to understand (page 33 *et seq.*) that there is no heat whatsoever from a neon lamp as used in television.

The book as a whole is good value and should afford entertaining reading.

E.H.T.

Machine Drawing and Design. By W. Abbott, B.Sc., A.M.I.Mech.E. Pp. 208. London: Blackie & Son, Ltd. 1930. Price 7s. 6d. net.

This volume is of an introductory but practical character, and is intended to provide an intermediate course in machine drawing and design for engineering students attending technical schools and colleges. The book is arranged in two parts. In Part 1 the more important details of machinery are described and illustrated, and the principles underlying their design are discussed. Part 2 is supplementary to the text of Part 1, and consists entirely of exercises in drawing and design, graded in difficulty, together with representative questions from recent examination papers, and at the end of each section throughout the book a number of well selected problems are given. The author's very considerable acquaintance with design and practice, and in the teaching of the subject, enable him to furnish just such a collection of drawings as will be of most service to students. The work possesses in a very high degree those admirable features which we have learnt to expect from the author's well-known volume on "Practical Geometry and Engineering Graphics."

The author's treatment of the theoretical considerations of machine drawing and design is reduced to as simple a form as possible, and is clearly set out with numerous examples and illustrations which materially add to the utility of the volume, especially for the purpose of technical instruction. The book includes a short section dealing with De Laval and combined impulse turbines, lucidly setting out the essential design principles involved. There is in the more practical section of the book valuable information dealing with the principles of projection, shaft fittings, bearings, and engine details. Particulars of design relating to pistons, piston rods, connecting rods, and cross heads are furnished, together with details of materials used in constructional work.

The book may be specially recommended for an initial study of the subject by engineering students who are studying the drawing and designing of machines of a simple character, without requiring an extensive knowledge of the advanced problems arising in the designing of more complicated and elaborate machines. The book is well produced, the numerous illustrations are excellent, and the publishers are to be congratulated upon selecting a size of page, and type and weight of paper which render the volume compact, light, and pleasing to the eye of the reader.

Plant Location. By W. Gerald Holmes. Pp. x+275. London: McGraw-Hill Publishing Co., Ltd. Price 15s. net.

The proper location of a manufacturing plant in relation to the market for its products and the source of supply of its raw materials is a factor of great importance in its effect on the competitive efficiency of a factory. This book is the outgrowth of the author's experience in plant location, and in it he applies the present-day trend towards scientific management to the solution of this problem.

The problem is perhaps of more importance in the United States, with its area of 3,000,000 sq. miles, than it is in Great Britain, with its 90,000 sq. miles. But the question is, nevertheless, of real interest to the business man of this country, especially in view of the tendency towards the establishment of branch factories in foreign countries.

The broad factors guiding the selection of a factory site are given as: (1) size and proximity of market; (2) location of raw materials, bearing in mind their relative economic importance; (3) transportation facilities and charges; (4) labour supply and wage conditions; (5) local laws and taxes; (6) other factors such as climate, cost of living, and building costs.

In accordance with modern methods of cost finding, the whole treatment of the problem is based on unit cost procedure. The various factors mentioned above are analysed to determine their relationships, and the most suitable site is sought on the basis of a comparison of costs per unit delivered to the customer.

The problem is dealt with in three stages in the book, narrowing down from the selection of one of the States to the choice of an actual site. The first section, which occupies 50 per cent. of the total number of pages in the book, deals with the selection of the general territory in which the factory is to be established. The analysis of the various factors governing plant location is profusely illustrated in this section, with statistics and historical data relating to the various American States. This rather reduces the practical value of the book from the viewpoint of the British business man, but it certainly assists in establishing the broad principles to be followed in making such an analysis.

In the second section, the author deals in a similar way with the selection of a particular community in the general district, and finally, in the third section, he indicates the factors to be taken into consideration in choosing a site in the selected community.

An interesting appendix to the book deals with a survey of plant location in Canada and the United States made in 1929 by the Metropolitan Life Insurance Company in co-operation with the National Electric Light Association. A summary of the report of the survey is given, including a selection from manufacturers' explanations of the reasons for their choice of plant location.

A.W.W.

A Handbook of Physics Measurements. By E. S. Ferry. Vol. II. Pp. xi+277; figs. 143. London: Chapman and Hall, Ltd. Price 12s. 6d. net.

With the current large number of practical text-books of physics, an additional one, and especially a new edition, could hardly call for notice were it of the conventional type. This book by Professor Ferry, has, however, several points of rather special interest, and is, moreover, a companion volume to his book on *General Physics*, which was recently reviewed in these columns. It deals with vibratory motion, sound, heat, electricity and magnetism. The chapter on each section is divided into two parts, essentially theoretical and practical, respectively. The theoretical parts are very well written, and in fact almost constitute a text-book in themselves, but it is, of course, the practical paragraphs by means of which the book stands or falls.

Speaking generally, the standard of the experiments is rather higher than that of the pure physics required as a subsidiary subject of an engineering course, and almost that of the pass degree work for physics as a main subject. Taking for example the vibration experiments—the graphical construction of Lissajou's figures, determination of the equation of a compound wave-form by Fourier's harmonic analysis, the study of damped vibrations and the determination of the specific viscosities of liquids by the vibrating-disk method—the three last require a moderate knowledge of the calculus in order to be thoroughly assimilated. The sound experiments are perhaps rather simpler, but they use shop-made apparatus, although nothing, apart perhaps, from tuning forks, which could not be made by a versatile laboratory mechanic. In the heat section most of the experiments are, again, simple, but a few of a technical nature are not usually performed outside of laboratories where applied physics is taught; these are the use of the bomb calorimeter, of Parr's comparison calorimeter, of Junker's calorimeter, and the determination of the economy effected by steam-pipe covering. The treatment of electricity and magnetism is a usual one. Supplementary directions are given in one appendix for various measurements in this, and in the twin volume—which we have not seen—on *Fundamental Measurements, Properties of Matter and Optics*, there is another on the sum of the series:—

$$\cos x + \cos 2x + \cos 3x + \ldots\ldots$$

and a set of tables, including one on the heat value of fuels. The first table, incidentally, "The Greek Alphabet," is perhaps a significant commentary on the extent to which even the *notation* of the classics—as a science student might describe it—is now unknown.

The binding is good, and the print and figures clear. Within its own somewhat limited sphere of reference, the book is completely successful.

Published Specifications.

Compiled expressly for this journal by a firm of chartered patent agents. The numbers in parentheses are those under which the specification will be printed and abridged, and all subsequent proceedings will be taken.

1928.

37,711. "Radio-telephone and the like systems." G. A. Mathieu. May 9th, 1929. (333,262.)

1929.

3,316. "Static electric transformers." G. R. Z. de Ferranti (legal representative of S. Z. de Ferranti, deceased) J. H. Whibley, and Ferranti Ltd. January 31st, 1929. (333,148.)

3,563. "Wireless transmitting and receiving apparatus." A. Graves. February 2nd, 1929. (333,150.)

3,603. "Lead-sheathed submarine cable." Siemens-Schuckertwerke Akt.-Ges. February 25th, 1928. (306,816.)

3,771. "Electric switching stations." British Thomson-Houston Co., Ltd. February 4th, 1928. (305,482.)

4,020. "Apparatus for the regulation of the individual motors in multiple-motor drives." Siemens-Schuckertwerke Akt.-Ges. February 10th, 1928. (305,668.)

4,249. "Protection of electric systems." British Thomson-Houston Co., Ltd. February 8th, 1929. (Addition to 305,667.) (Convention date not granted.) (305,637.)

7,548. "Thermionic valves." Dr. B. Loewe. March 7th, 1928. (308,624.)

10,105. "Electron-discharge device." Loewe-Radio Ges., and Dr. E. Römhild. March 30th, 1928. (308,978.)

10,399. "Thermionic cathodes." Dr. B. Loewe. April 5th, 1928. (309,140.)

10,724. "Electric switches." W. V. Butterfield, W. E. Evans, A. W. Butterfield, and S. Butterfield (trading as Mycromet Manufacturing Co.). January 1st. 1930. (332,973.)

10,769. "Electric plugs and sockets." W. J. Pritchett. April 8th, 1929. (333,245.)

10,984. "Relay connections for electric protective arrangements." Siemens-Schuckertwerke Akt.-Ges. August 18th, 1928. (Patent of addition not granted.) (317,466.)

11,083. "Wireless telephony and telegraphy." L. A. Chapman. April 10th, 1929. (333,270.)

11,111. "Manufacture of telephone cables." Siemens-Schuckertwerke Akt.-Ges. May 23rd, 1928. (312,265.)

12,834. "Heat fuses for use in connection with electric and other furnaces." Birmingham Electric Furnaces, Ltd., and A. G. Lobley. April 25th, 1929. (333,199.)

13,590. "Amplifying systems for weak electric currents." W. H. Bristol Talking Picture Corporation. May 1st, 1928. (310,857.)

13,659. "Electricity meters." Chamberlain & Hookham, Ltd., and S. James. May 2nd, 1929. (333,170.)

13,699. "Electric selective remote-control systems." A. Reyrolle & Co., Ltd., B. H. Leeson, and D. E. Lambert. May 2nd, 1929. (333,172.)

13,751. "Electrolytic deposition of gold." W. F. Grupe. May 3rd, 1929. (333,246.)

13,800. "Electric switches for motor vehicles primarily for controlling the lamp circuits thereof." J. Lucas, Ltd., and H. Foxall. May 3rd 1929. (Cognate application, 16,386/29.) (333,179.)

13,808. "Signalling-circuit arrangement comprising a hybrid coil." Standard Telephones & Cables, Ltd., and W. N. Roseway. May 3rd, 1929. (333,180.)

13,813. "Protection of electric supply circuits or systems." Crompton Parkinson, Ltd. and H. Astbury. May 3rd, 1929 (333,206.)

13,814. "Fusible electric cut-outs." Crompton Parkinson, Ltd., and G. Page. May 3rd, 1929. (Cognate application, 2,362/30.) (333,207.)

13,841. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., and R. Taylor. May 3rd, 1929. (333,182.)

13,855. "Coil ignition apparatus for motor-cycles and the like." British Thomson-Houston Co., Ltd., L. Griffiths, and C. J. Morton. May 3rd, 1929. (333,225.)

13,871. "Electromagnets." B. N. Sokoloff. May 3rd, 1929. (333,209.)

14,023. "Switching mechanisms for use in telephone systems." Standard Telephones & Cables, Ltd., and M. S. Snell. May 6th, 1929. (333,213.)

14,059. "Circuit arrangements for frequency transformation." S. G. S. Dicker (Naamlooze Vennootschap Philips' Gloeilampenfabrieken). May 6th, 1929. (333,215.)

14,124. "Electric controlling and signalling systems." Associated Telephone & Telegraph Co. May 5th, 1928. (311,188.)

14,208. "Electric heaters for heating air in rooms and the like." British Thomson-Houston Co., Ltd. May 8th, 1928. (311,281.)

14,217. "Electric resistances." General Electric Co., Ltd., and H. Bird. May 7th, 1929. (333,247.)

14,321. "Electromagnetic direction-indicator for use on motor vehicles." Spezial-Werkzeugfabrik Feuerbach Ges. June 8th, 1928. (313,152.)

14,393. "Coreless electrical induction furnaces." N. R. Davis, P. G. H. Burbridge, and Associated Electrical Industries, Ltd. May 8th, 1929. (333,254.)

14,412. "Electric discharge devices." H. J. Spanner and U. Döring. May 8th, 1928. (311,294.)

14,436. "Submarine electric signalling conductors." Electrical Research Products, Inc. June 6th, 1928. (313,076.)

14,694. "Manufacture of electric insulating materials." W. S. Smith, H. J. Garnett, and J. N. Dean. May 10th, 1929. (333,290.)

14,696. "Process for the production or influencing of a diaphragm for electro-osmotic purposes." Siemens & Halske Akt.-Ges. May 18th, 1928. (312,068.)

14,716. "Batteries." S. J. Rubinstein. May 10th, 1929. (333,291.)

15,006. "Automatic and semi-automatic telephone exchange systems." Standard Telephones & Cables, Ltd. (G. Deakin and L. Polinkowsky). May 14th, 1929. (333,259.)

15,007. "Automatic and semi-automatic telephone exchange systems." Standard Telephones & Cables, Ltd. (G. Deakin and L. Polinkowsky). May 14th, 1929. (333,299.)

15,008. "Testing arrangements for automatic or semi-automatic telephone systems." Standard Telephones & Cables, Ltd. (G. Deakin and L. Polinkowsky). May 14th, 1929. (333,300.)

15,063. "Variable inductances." Burndept Wireless (1928), Ltd., and M. G. Scroggie. May 14th, 1929. (333,305.)

15,316. "Electrical signalling systems and means for use with microphonic apparatus." Graham Amplion, Ltd., and C. F. Phillips. May 16th, 1929. (333,310.)

15,318. "Sound-amplifying apparatus and systems." Graham Amplion, Ltd., and C. F. Phillips. May 16th, 1929. (333,312.)

15,692. "Method and means for regulating the electrodes in tilting furnaces." W. W. Triggs (Flodinjern Aktiebolag). May 21st, 1929. (333,318.)

16,176. "Acoustical apparatus employing sound-resonant diaphragms." Soc. Française Radio-Electrique and M. Bernard. May 25th, 1929. (333,323.)

16,726. "Telephone systems." F. J. Keene. May 30th, 1929. (333,330.)

16,878. "Radio-receiving apparatus." L. L. De Kramolin. May 31st, 1928. (312,698.)

17,665. "Electrical driving of machines, or other apparatus or shafting." H. R. Ross and R. Cunningham. June 8th, 1929. (333,337.)

17,837. "Radio-receiving apparatus." L. L. De Kramolin. June 8th, 1928. (Addition to 301,498.) (313,414.)

19,888. "Controlling means for electrical controlling apparatus." W. W. Triggs (Felten & Guilleaume Carlswerk Akt.-Ges.). June 28th, 1929. (333,348).

22,947. "Insulators of electric fuses and other electrical insulators." Simplex Conduits, Ltd. and H. F. McLoughlin. July 26th, 1929. (333,372.)

23,143. "Telephone transmission systems." Automatic Telephone Manufacturing Co., Ltd., T. R. Rayner, and J. Smith. July 27th, 1929. (333,374.)

23,292. "Polarised call-bells." Telefonaktiebolaget L. M. Ericsson. August 4th, 1928. (Patent of addition not granted.) (316,876.)

23,575. "Electric purification of gases containing hot vapours." Siemens-Schuckertwerke Akt.-Ges. August 1st, 1928. (316,626.)

23,763. "Telephone systems." Siemens Bros. & Co., Ltd., and W. H. Grinsted. August 2nd, 1929. (333,386.)

23,842. "Clock-actuated electric switches." P. O. Dorer and S. Smith and Sons (Motor Accessories), Ltd. August 2nd, 1929. (333,388.)

23,895. "Thermionic amplifiers." H. Clarke & Co. (Manchester), Ltd., and H. Ingham. August 3rd, 1929. (333,390.)

24,584. "Alternating-current ampere-hour meters." A. G. S. Sandison. August 12th, 1929. (333,395.)

26,050. "Electrical apparatus for drying the hands." A. Cooymans. August 27th, 1929. (333,410.)

27,167. "Pupin coil-boxes." Felten & Guillcaume Carlswerk Akt.-Ges. October 2nd, 1928. (333,417.)

28,749. "Process for ensuring stability of operation in the electrical cleaning of gases from revolving furnaces." Lodge-Cottrell, Ltd. (Metallges. Akt.-Ges.). September 23rd, 1929. (333,427.)

29,028. "Electromagnetic devices embodying electromagnets with moving armatures." Standard Telephones & Cables, Ltd. (Western Electric Co., Inc.). September 25th, 1929. (333,428.)

29,709. "Field-control systems for alternating-current generators intended to operate on long transmission lines." British Thomson-Houston Co., Ltd. October 1st, 1928. (333,436.)

30,820. "Thermionic valve amplifying systems." Victor Talking Machine Co. October 10th, 1928. (333,451.)

31,296. "Electric induction furnace." Hirsch, Kupfer-und Messingwerke Akt.-Ges. October 15th, 1928. (333,455.)

31,914. "Electric furnaces." British Thomson-Houston Co., Ltd. October 23rd, 1928. (333,457.)

32,366. "Electric circuit-breakers." H. Milliken. October 24th, 1929. (333,459.)

32,987. "Electrolytic deposition of gold and silver." A. Mozer. December 11th, 1928. (333,462.)

37,396. "Electric insulators." J. F. Phillips. December 5th, 1929. (333,483.)

37,710. "Electric cable-impregnating apparatus." J. Pintsch Akt.-Ges. December 20th, 1928. (333,485.)

39,019. "Electric switches." G. H. Ide and H. L. Bentley. December 20th, 1929. (Addition to 313,356.) (333,490.)

1930.

1,740. "Electric cables." P. H. Chase. January 17th, 1929. (333,497.)

2,322. "Multiple-core electric cables." Naamlooze Vennootschap Hollandsche Draad-en Kabelfabriek. December 27th, 1929. (333,498.)

6,230. "Thermionic amplifying systems." British Thomson-Houston Co., Ltd. February 26th, 1929. (333,502.)

Trade Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from August 27th :—

CCA Giant Poliflor (lettering and design). No. 513,109. Class 6. Electric floor-polishing machines.—CCA (Vacuum Cleaners), Ltd., Swinton House, 324, Gray's Inn Road, W.C.1.

Easco (lettering and design). No. 513,380. Class 8. Electric batteries and electric induction coils (not for medical purposes).—E. L. Eastell, trading as the Electrical Auto-Services Co., 1, Brixton Road, S.W.9.

Airchrome. No. 513,820. All goods in Class 8.—Ultra Electric, Ltd., 661-663, Harrow Road, N.W.10.

Pentamite. No. 514,407. Class 8. Radio-telephonic and telegraphic instruments and apparatus and parts thereof.—Radio Instruments, Ltd., Purley Way, Croydon.

Valtrex. No. 514,838. Class 8. Instruments and apparatus for use in radio-telegraphy and telephony.—Riversdale Radio Supply Co., Ltd., 48, Thames Street, Kingston-on-Thames.

EECPLD (lettering and design). No. 511,580. Class 13. Plaques, lamp standards, and statuary, all being metal goods.—Einstein's Electro-Chemical Process, Ltd., 38, Old Queen Street, S.W.1.

Electrical Refrigeration at Sea.

The motor vessel *Otaio* was launched at Messrs. Vickers-Armstrong's Naval Construction Works, Barrow, on Tuesday, August 26th, for the New Zealand Shipping Co., Ltd., under the supervision of Messrs. Esplen, Son & Swainston, Ltd., London. The vessel is 490 ft. in length overall, 67 ft. in breadth, will have a speed of 15¾ knots, and a minimum dead weight of 12,300 tons. Five of the cargo holds and several of the between-deck spaces are being insulated for the carrying of refrigerated cargoes. Electricity on the ship is supplied by three Ruston and Hornsby Diesel generator sets of 300 kW each, and is used throughout for lighting and heating, while all the auxiliary and deck machinery is also electrically driven, and the vessel is fully equipped and fitted as a first-class cargo liner suitable for summer service in tropical climates and also for winter service in the North Atlantic. The main propelling machinery consists of two Doxford opposed piston airless injection engines having four cylinders each with a diameter of 27½ inches, and combined stroke of 82½ inches, giving a total of 9,400 brake-horse-power at 120 revolutions per minute.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ABERDEEN.—Extensions at Corporation's workshops (£11,000); city architect.

ALDENHAM (WATFORD).—Two factories, Boreham Wood, for Celloda Co., Ltd. Houses (468), Boreham Wood and Radlett, for the Allied Building Corporation.

BIRMINGHAM.—Omnibus garage, Perry Barr; city engineer.

BOSCOMBE (BOURNEMOUTH).—Re-erection of Savoy Picture House, Christchurch Road, for Handford, Husband and File; A. F. Roberts, manager.

BRADFORD.—Hospital buildings (240 patients), Westwood estate, Clayton Heights; city architect, Town Hall.

BLACKBURN.—School (£16,000); director of education.

BURNLEY.—Improvements, Palace Theatre, Barnoldswick; Halstead Best, architect.

BURSLEM.—Extensions, Elgrave pottery; Wood & Goldstraw.

BURTON-ON-TRENT.—School (800 places), Clarence Road, for the borough E.C.; director of education.

CAMBRIDGE.—Extensions, Aldenbrooke's Hospital (£22,000); Mr. Keay, architect.

CHAPEL-EN-LE-FRITH.—Sewage disposal works, Hope, for R.D.C.; Brady & Partington, civil engineers.

CHELMSFORD.—Infants' school, Trinity Road, for the E.C.

CHICHESTER.—Re-erection of Ellanor House for Lady Phillimore, Henley-on-Thames.

CHINGFORD.—Masonic Hall, Station Road; Stanley R. Miller, architect.

CHORLEY.—Three schools for the E.C.

COVENTRY.—Houses (242), Hill Farm estate, for the T.C.; city surveyor.

CREWE.—Senior school for the borough E.C.; borough surveyor.

CROYDON.—Reconstruction of *Croydon Times* offices and printing works, High Street; F. W. Rees & Partners, architects. Offices and motor showrooms, South End and Lower Coombe Road; L. H. Harrington.

DEVON.—Junior school at Hooe, Plymstock; county architect, 97, Heavitree Road, Exeter.

DORSET.—School, Wimborne, for the E.C.; J. L. Torr, clerk, Dorchester.

DOUGLAS (ISLE OF MAN).—Extensions, Villa Marina, including arcade, &c. (second section), for the T.C.; E. P. Mawson, architect, High Street House, Lancaster.

DUNSTABLE.—Houses (120) for the T.C.; T. Alwyn Lloyd, architect.

EDINBURGH.—Alterations and extensions at Geological Survey Office, Grange Terrace; architect, H.M. Office of Works, 122, George Street. Additions, Tollcross School; city architect.

ELLESMERE PORT.—Municipal offices for the U.D.C.; J. M. Hudson, architect.

EPSOM.—Telephone exchange for H.M. Office of Works, King Charles Street, London, S.W.

FALKIRK.—Omnibus station, &c., for Walter Alexander and Sons, Camelon; J. G. Callander, architect, Falkirk.

GLASGOW.—Bank buildings, West George Street and West Nile Street; Commercial Bank of Scotland, Ltd.

HAMPSHIRE.—Senior school, Christchurch (£22,000); county architect.

HAYDOCK.—Public library for the War Memorial Committee; Baxendale Bros. (Chorley), Ltd., contractors, Chorley, Lancs.

HEYWOOD.—Court and police station (£23,000); Lancashire Standing Joint Committee.

HOUGHTON-LE-SPRING.—Houses (100) for the R.D.C.; surveyor.

IRISH FREE STATE (MONAGHAN).—Extension of boarding school, Convent of St. Louis; W. Tudor, architect, 79, Royal Avenue, Belfast.

KIDDERMINSTER.—Cinema, Oxford Street; Webb & Gray, architects. Nurses' home, General Hospital; H. E. Rolley, architect.

LANCASHIRE.—Elementary school, Littleborough, and extensions, technical institute, Oswaldtwistle, for the county E.C.

LINDSEY (LINCS.).—Schools, Ashby and Scotter, for the E.C.; H. C. Gamble, county architect, Bank Street Chambers, Lincoln.

LIVERPOOL.—Cinema, London Road; Frank T. Verity, architect, London, W.

LONDON (ILFORD, E.).—Houses (100) and shops, Stome Hall Farm estate; J. Aldridge. Houses (88), Kenwood Gardens estate; T. Anders. Elementary school, Eastern Avenue, for the E.C.

(EAST HAM, E.).—Mental hospital (1,050 patients); borough engineer.

(ST. MARYLEBONE, N.W.).—Buildings, Little Church Street; E. W. Banfield. Building, Marylebone Road, Harley Street, and Devonshire Place; C. H. Biddulph Pinchard.

(CATFORD, S.E.).—Development, Hall Park estate, Bromley Road; J. Everington.

(LAMBETH, S.E.).—Tenements, Wilcox Road; Messrs. Clutton, for Ecclesiastical Commissioners.

MANCHESTER.—Houses (370), Gorton, for the T.C.; city surveyor. Extensions, Victoria University College; Thomas Worthington & Sons, architects.

MARPLE.—Swimming baths Stockport Road and Union Road (£8,000); J. W. Swindells, Ltd., builders, Church Road, New Mills, near Stockport.

NEWBURY.—Cinema; H. Scott, architect, Birmingham.

NORTH BERWICK.—Alterations and additions to High School (electrical work and heating installation); R. and A. K. Smith, surveyors, Forres Street, Edinburgh.

PLYMOUTH.—Extensions, Beechwood Factory, Alexandra Road; Brown, Wills & Nicholson. Alterations, Dye works, Market Street, Stonehouse; W. Baptie & Son.

PORT TALBOT.—Extension of south pier for Great Western Railway; engineer, Port Talbot station.

PRITTLEWELL.—Houses (435), Earls Hall Garden Estate, Ltd.; Talbot & White, agents, Clarence Street, Southend-on-Sea.

ST. BEES (CUMBERLAND).—Electric lighting installation work for the Grammar School governors; the bursar.

SITTINGBOURNE.—Electric lighting installation, Keycol Hospital, for the Joint Hospital Board; T. W. Ellis, consulting engineer.

SOUTHEND-ON-SEA.—Pier extensions and improvements (£50,000), for the T.C.; borough engineer. Municipal buildings, Victoria Avenue; Prof. Adshead.

STAFFS.—Two schools, Kidsgrove, and extensions, Ogley Hay infants' school; F. A. Hughes, director of education, county education offices, Stratford.

STIRLING.—Houses (118) for the T.C.; burgh surveyor.

STOCKPORT.—Cinema theatre, café, and billiard hall, and eleven shops, Buxton Road, Great Moor; plans by A. Hartley, 128, Buxton Road, Heaviley, Stockport.

STRATFORD-ON-AVON.—Offices for the R.D.C.; F. W. Bagnall Yorke, architect.

SURBITON.—Reconstruction of Coronation cinema; Martin Hatfield & Partners, architects.

SWAFFHAM.—Extensions, Hamond's Grammar School; S. J. Wearing, architect, 3, Redwell Street, Norwich.

SWANSEA.—Bank improvements, Glanmor Terrace and The Dunns; Lloyds Bank, Ltd. Rebuilding of 31, Waterloo Road; J. Bloomberg & Son.

TEDDINGTON.—Municipal offices (£35,000); U.D.C. surveyor.

WATFORD.—Houses (50), Berry Avenue and Pomeroy Crescent; Kempster & Williams.

YORK.—Development of Grange estate, Fulford Road; R. J. Pullen & Sons. Estate development, Heslington Lane; J. Allison & Sons, Ltd. Extensions, Hull Road; York Engineering & Foundry Co., Ltd. Extensions, Mill Mount secondary school for the E.C. School, Fifth Avenue; St. Georges R.C. trustees.